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SCHØYEN (T. H.) & JØRSTAD (I.). **Skadedyr og Sygdommer i Frukt- og Baerhagen.** [Pests and diseases in the orchard and small-fruit garden.]—136 pp., 23 pl., Oslo, H. Aschehoug & Co., 1942. [Abs. in *Z. PflKrankh.*, liii, 1–3, p. 141, 1943.]

The coloured plates illustrating the pests and diseases of stone, pome, and small fruits in Norway are stated by the reviewer to be of unusual excellence, and in this connexion attention is drawn to the increasing use of colour in manuals of plant protection.

HILDEBRAND (E. M.). **Peach-suture spot.**—*Phytopathology*, xxxiii, 2, pp. 167–168, 1 fig., 1943.

A new disease of peaches, apparently affecting only the fruit, has been observed in an Elberta orchard on the shore of Lake Ontario in Wayne County, New York, and is believed to be identical with a disorder encountered in the Niagara Peninsula of Ontario in 1940. The conspicuous and distinctive lesions are situated exclusively in the suture region, hence the name of 'suture spot' is suggested to describe the condition, which is quite different from the red suture occurring in Michigan [*R.A.M.*, xx, p. 480]. The irregularly oblong-ovate, occasionally narrow elongate to nearly circular lesions usually develop across the suture, occupying three-quarters of its length and a maximum of one-eighth the circumference midway between the ends of the fruit. They originate beneath the skin as water-soaked, red-tinged areas, the centres of which soon turn brown, sink, and shrivel with the death of the affected tissues, while the red outer rim remains level with or slightly above the fruit surface. On sectioning, the texture of the diseased tissues is found to be somewhat corky and tough, with the vascular system in prominent relief. After about six weeks in storage only a few of the lesions on incompletely ripe fruits had expanded slightly. Suture spot is essentially a disease of harvest-time, at which period the affected trees, sometimes surrounded by entirely healthy ones, may easily be located by the fallen fruits on the ground. The cause is unknown, but failure of attempts to isolate bacteria or fungi from the lesions suggests that the disease may be due to a virus or a physiological factor.

BODINE (E. W.), NEWTON (J. H.), & KREUTZER (W. A.). **Four new virus diseases of stone fruits found in Peach mosaic study in Colorado.**—*Fm Bull. Colo. agric. Exp. Sta.*, iv, 2, pp. 6–10, 4 figs., 1942.

Golden net of peaches is the only one of the four virus diseases here described to which reference has not already been made, the others being rasp leaf of cherry [*R.A.M.*, xxi, p. 378], ring spot of apricot [ibid., xxi, p. 339], and the well-known X disease of peach, all except the last-named being reported exclusively from Colorado, where their existence has been revealed by the studies of peach mosaic in progress since 1934. Golden net was first observed on apricots and plums in 1937 and on the Elberta peach in 1939, the prominent marginal yellowing of the veins of the last-named host being responsible for the designation of the disease. During the

growing season irregular yellow areas also appear on the leaf blade, but the twigs and fruits do not suffer. Apricot trees are more severely affected, the leaves frequently showing interveinal crinkling and mottling, new stem growth being definitely stunted, and the market value of the fruits impaired by malformations and bumpiness. The only symptom of the disorder on Satsuma plums is a faint marginal mosaic of some of the leaf blades, often associated with irregular yellow blotches.

CHRISTOFF (A.). **Crown gall on fruit trees in Bulgaria.**—*Rev. Inst. Rech. agron. Bulg., 1940*, x, pp. 3–27, 1940. [Abs. in *Plant Breed. Abstr.*, xiii, 2, p. 156, 1943.]

The author reviews the literature on crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) and discusses the effects of the disease on its hosts, the range of the latter (including those found in Bulgaria), the geographical distribution of the pathogen, its identification, biological and physiological characters, economic significance, methods of isolation and culture, control, and the existence of races resistant to the specific bacteriophage [*R.A.M.*, xviii, p. 158].

In connexion with the necessity for the provision of resistant stocks, the results of the writer's experiments in the inoculation of 113 lots of rootstocks, representing six species of *Prunus*, with *Bact. tumefaciens* are recorded. The extent of tumour formation in the various stocks was found to vary considerably. In a final test on a group of ten selected stocks, one (*P. insititia*) was ascertained to be completely resistant, while another (*P. spinosa*) contained only two infected trees out of six.

WILLIAMS (C. C.), CAMERON (E. J.), & WILLIAMS (O. B.). **A facultatively anaerobic mold of unusual heat resistance.**—*Food Res.*, vi, 1, pp. 69–73, 2 graphs, 1941.

Two strains of a species of *Penicillium*, stated by C. Thom to be apparently undescribed, were isolated on wort and blueberry juice agar from blueberries in high-vacuum, enamel-lined cans and from the soil of five fields in which the crop was grown. One of the strains produced sclerotia exhibiting an exceptional degree of resistance to heat, being capable of withstanding upwards of 93·3° C.

RANGEL (J. F.). **Toxicologia dos desinfestantes das sementes.** [The toxicology of seed disinfectants.]—*Bol. Esc. nac. Agron., Rio de J., 1941*, 2, pp. 185–223, 1 fig., 1 graph, 1942. [English summary.]

With a view to the establishment of a standard method for the determination of the relative toxicity of seed disinfectants, the author investigated the experimental techniques of various foreign phytopathologists, as well as their different modes of estimating, expressing, analysing, and interpreting the resultant data. He tentatively accepts for this purpose the modification of Reddick and Wallace's 'slide-moist chamber method' proposed by the Committee on Standardization of Fungicidal Tests of the American Phytopathological Society (1940) and discusses various aspects of tests devised by several authors, accounts of which have already appeared in this *Review*.

In conclusion he emphasizes that besides its fungicidal and protective properties, other qualities of a seed disinfectant requiring consideration in connexion with its applicability for the end in view are its potential phytocidal effect, particle size, friction inducing capacity, hygroscopicity, and action on iron.

TRAPPMANN (W.). **Pflanzenschutzmittel — gestern, heute und morgen.** [Plant-protectives—yesterday, to-day, and to-morrow.]—*Z. PflKrankh.*, liii, 1–3, pp. 93–106, 1943.

The following factors are discussed in relation to the development and elaboration of plant-protectives in Germany: (1) progress of biological research, (2) inten-

sification of agriculture, (3) world commerce and economy, (4) extension of the chemical industry and steady advance in the knowledge of chemistry, (5) the official German service for the testing of plant-protectives, (6) the world economic crisis, and (7) the need of planning for an expansion of the continental 'living space'.

After a historical introduction it is stated that during the last few years of peace, German agricultural products, including plant-protectives, found many new markets, especially in the Balkans and South America. At first the preparation and distribution of plant-protectives fell to the lot of the State research and experiment stations, but with increasing technical refinements and complications in the application of the treatments it became necessary to entrust the work of manufacture to the chemical industry, the achievements of which should be accorded full recognition. To-day it annually supplies the Reich with, *inter alia*, 20,000 tons of copper-containing or equivalent fungicides, 4,000 tons of sulphur sprays, and 10,000 tons of fruit tree carbolineum. Released from the actual preparation of the antiseptics, the research stations once more reverted to their normal functions of testing the chemical products submitted to them and transmitting to the industry their views on any necessary improvements. Future developments in the production of plant-protectives will thus be based on the co-operation of scientific and technical specialists. These observations are also applicable to the branch of engineering concerned with the manufacture of spraying and dusting machinery.

The official testing of industrial proprietary preparations, initiated by E. Riehm in 1913, amplified by the German Plant Protection Service in 1919, and extended on a legal footing in 1937 to include plant-protective equipment and storage disinfectants, is carried out at the Biological Institute, and among the objects thereby attained are (1) the exclusion from the market of worthless products, a public warning against which may be issued; (2) identification of reliable preparations by reference to their effective ingredients, e.g., derris and nicotine dusts; (3) general improvement in quality by comparison of all new products with the best on the market at the time, known as the 'standard', to which practice is attributed the high reputation enjoyed by German plant-protectives both at home and abroad; (4) standardization of the principal fungicides and insecticides, the standards set representing the Biological Institute's minimum demands for all products comprised in these groups; (5) elaboration of specially economical preparations to serve as 'universal disinfectants' for cereal seed-grain in connexion with the saving of raw materials; and (6) insurance of uniform composition by chemical supervision of the trade. In 1942 the numbers of officially recognized cereal seed-grain disinfectants, orchard, viticultural, horticultural, and agricultural plant-protectives, and storage pest-preventives were 9, 466, and 37, respectively, while the preparations submitted for preliminary testing numbered 213; these figures compare with four seed-grain disinfectants and 33 new products in 1922, when the other two groups were not represented at all.

With the advent of war the Biological Institute was called upon to help with the problem of a plant-protection policy. As a result, the manufacture of plant-protectives was concentrated in a small number of efficiently organized and fully utilized factories and limited to a few products recognized as contributing to the successful prosecution of the war, without making excessive demands on the raw material resources, all others, including copper- or sulphur-containing compounds, being rejected as superfluous for present-day needs.

Control of plant pests and diseases.—*Chem. & Ind.*, lxii, 21, p. 195, 1943.

The Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland are now prepared to receive applications from manufacturers or their

agents for consideration for official approval of plant-protectives of the following groups: (1) lead arsenate powders, (2) lead arsenate pastes, (3) lime-sulphur, (4) miscible tar oil winter washes, (5) stock emulsion tar oil winter washes, and (6) the organo-mercury dry seed dressings containing organo-mercury compounds as the sole active principle [*R.A.M.*, xxii, p. 71]. Requests for forms, indicating the number of applications to be submitted in each of the above groups, should be sent to the Secretary of the Advisory Committee, Plant Pathology Laboratory, Milton Road, Harpenden, Herts.

Mack (G. L.) & Reinking (O. A.). **The determination of particle size of fungicidal materials.**—Abs. in *Phytopathology*, xxxiii, 1, p. 8, 1943.

Particle size is the physical attribute of powdered fungicides [*R.A.M.*, xxii, pp. 146, 147, *et passim*] that chiefly determines the degree of their efficacy in disease control, and much confusion has arisen through the use of different terms for the designation of fineness and numerous methods of measurement. The lack of uniformity in size and shape of the particles present in all commercial wettable sulphur and insoluble copper fungicides causes a four- or fivefold variation between the largest and smallest of the several average diameters used to express particle dimensions. The shape factor in these disinfectants is of relatively slight importance, since the form of the individual particles in most cases approximates to that of a sphere.

The particle size of 11 representative copper and sulphur fungicides was ascertained by four entirely independent methods and expressed as three different average diameters. The Andreasen sedimentation and the air permeation techniques yielded concordant data. The diameter of the particle of average specific surface appeared to be that most nearly related to the comparative toxicity of the materials tested. Specific surface being a property independent of the degree of uniformity of the sample and closely correlated with fungicidal toxicity, this term is proposed to express the fineness of plant-protective dusts.

Hamilton (J. M.). **Comments from the study of fungicides in 1941.**—*Proc. N.Y. St. agric. Soc.*, *1942*, pp. 41–42, [1942].

Flotation sulphur paste, purchased for use during the coming season, should be obtained freshly made, whereas with the dry-wettable forms, the older they are, the better. Both in 1940 and 1941, bentonite hastened the setting of the dry wettables. Its use was, however, detrimental if rain fell within 15 minutes of spraying under poor drying conditions. Lime (1 in 100) gave ideal results after 15 minutes, and its use with wettable sulphurs to increase adhesiveness is thoroughly desirable when they are applied in unsatisfactory drying conditions.

Orthex [*R.A.M.*, xxi, p. 244] inhibited the fungicidal action of sulphur when the spray mixture was cold (50° F), or when the water was obtained from a running stream early in the season. With water at about 70°, orthex does not act in this way and gives a film on the foliage resembling that seen when the leaves are wet. Lime (1 in 100) eliminates or considerably reduces the smothering effect of the orthex with cold water.

The evidence demonstrated that the use of a sticker is less important than adjustment of the spray mixture to give a uniform film of spray on the leaves. Mineral oil stickers tend to inhibit fungicidal action, though vegetable oils do not. Some other stickers also materially reduce fungicidal effectiveness.

Orthex may be employed in showery weather before the cover sprays. SS-3 and sprasoy A with lime ½ in 100 are good spreaders, the latter particularly with lime-sulphur, and the former with Bordeaux mixture.

McNew (G. L.). **Relative effectiveness of organic and inorganic fungicides as seed protectants.**—Abs. in *Phytopathology*, xxxiii, 1, p. 9, 1943.

At least three organic fungicides have shown promise as substitutes for the copper and mercury compounds now in use as vegetable seed protectants, namely, tetrachloro-para-benzoquinone (spergon) [*R.A.M.*, xxii, p. 160], ferric dimethyldithiocarbamate (fermate) [ibid., xxii, p. 213], and tetramethyl thiuramdisulphide (thiosan) [ibid., xxii, p. 115], which have effectively prevented infection by *Pythium ultimum* in greenhouse tests and also given excellent results in the field [in Wisconsin]. These preparations are the only ones suitable for application to Lima beans [*Phaseolus lunatus*], and they appear to be superior to the metallic treatments on peas. Sufficient data have been obtained to recommend spergon for peas and Lima beans but further tests of fermate and thiosan are required for these two crops and for spinach and sweet corn [maize]. In replicated experiments with nine treatments on sweet corn in 1942, thiosan produced the heaviest increase in yield (20 per cent.) followed by semesan jr., barbak C [ibid., xix, p. 636], and spergon. The augmented yields of peas were due to the prevention of seedling loss from pre-emergence seed decay and of weakening of the plants through post-emergence infection.

Palmiter (D. H.) & Hamilton (J. M.). **A new fungicide.**—*Proc. N. Y. St. Agric. Soc. 1942*, pp. 207–209, [1942].

Experiments in the Hudson Valley made to find an organic fungicide superior to sulphur in fruit disease control demonstrated that ferric dimethyldithiocarbamate [fermate: see preceding abstract] is at least twice as toxic as sulphur to the spores of some fungi and sticks better than most other organics, while it costs about the same as sulphur fungicides. At 2 in 100, it controlled apple scab [*Venturia inaequalis*] on McIntosh trees as effectively as the best dry wettables at 5 in 100 or flotation paste at 8 in 100. Used only in the cover sprays at 1 in 100, it was as effective as flotation paste at 6 in 100, and reduced infection to under 1 per cent. When five applications at ½ in 100 (pink, bloom, calyx, and first and second cover) were made on Rome trees in comparison with similar applications of micronized sulphur 5 in 100, it gave perfect control of cedar rust [*Gymnosporangium juniperi-virginianae*], though the sulphur reduced leaf infection by only 50 per cent. When the bloom spray was omitted, fermate ½ in 100 and 1½ in 100 gave 81 and 94 per cent. control, respectively, though sulphur 5 in 100 gave only 16 per cent.

Used against sweet cherry brown rot [*Sclerotinia fructicola* and *S. laxa*] just before picking, fermate ½ in 100 plus ½ pint cottonseed oil spreader left no visible residue and protected the fruit from decay for several days under conditions favourable for rot development. Applied two weeks before harvest at 1 in 100 plus cottonseed oil it gave the fruit complete protection, though 4 in. of rain fell during this period; the fruit had no objectionable residue when picked. Under the same conditions, micronized sulphur 2 in 100 plus cottonseed oil allowed 50 to 60 per cent. of the fruit to become infected before harvest. An additional advantage of the use of cottonseed oil is that it reduced cracking caused by rains.

Baker (R. E. D.). **Notes on some diseases of field crops, vegetables and fruits at the Imperial College of Tropical Agriculture.**—*Trop. Agriculture, Trin.*, xx, 2, pp. 28–32; 3, pp. 59–63, 1943.

These notes, based on observations recorded from 1939 to 1942 at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, deal with bacterial, fungal, virus, and nematode diseases of cereals, sugar-cane, fodder grasses, root crops, legumes, fruits, vegetables, and miscellaneous crops including cotton and tobacco [cf. *R.A.M.*, xxi, p. 281].

RIEHM (E.). **Über die Zunahme der Pflanzenkrankheiten und Schädlinge.** [On the increase of plant diseases and pests.]—*Z. PflKrankh.*, liii, 1–3, pp. 1–12, 1943.

This is a discussion, illustrated by concrete examples and references to the relevant literaure, of the complex problem of the increase in the number and intensity of plant diseases in Germany. Entirely divergent conclusions as to the rising or falling incidence of plant pathogens have been reached by different workers, Blunck, for instance, expressly affirming (*Z. PflKrankh.*, xxxix, p. 1, 1929: *Oldenburg. LandwBl.*, p. 1946, 1930) that epidemics are on the upward grade both in numbers and severity, while Morstatt [*R.A.M.*, xiii, p. 588] is of the opinion that German agriculture is threatened only by the introduction of foreign parasites, though an intensification of the economic importance of already existing diseases is conceded. In the present writer's view, neither opinion can be categorically confirmed since appreciation depends on the duration of the periods compared and on the different conditions governing the occurrence of individual vegetable and animal parasites.

It must be admitted that the last fifty years have seen a decline in the losses due to many plant pathogens, and it is, indeed, barely conceivable that all the efforts made to minimize the damage should have borne no fruit, unless either the virulence of the parasites or the susceptibility of their hosts should have increased to such an extent that counter-measures merely served to restore the equilibrium and reduce the resultant losses to a tolerable level. In actual fact, however, a number of diseases have been entirely deprived of their economic significance by plant-protective methods. Ergotism, for instance, due to the consumption of flour made from rye infected by ergot [*Claviceps purpurea*], was common in various parts of the country some 90 years ago and occurred in a severe form in East Prussia in 1867–8 (E. Meyer; Beitrag zur Entwicklungsgeschichte der Phytopathologie und des Pflanzenschutzes, Inaug. Diss., Berlin, 1928), but has now become a rarity except in the absence of up-to-date cleansing facilities (*Öffentl. GesundhDienst*, viii, p. 213, 1942). Wheat bunt [*Tilletia caries* and *T. foetida*] is in general much less prevalent than it was 50 years ago, and among fruit diseases of steadily diminishing importance may be mentioned American gooseberry mildew [*Sphaerotheca mors-uvae*], once the cause of 'heavy depredations' (*Ber. Landw. Berl.*, 30, p. 123, 1910) and apple scab (*Fusicladium*) [*Venturia inaequalis*]. On the other hand, virus diseases, notably of potatoes, are obviously spreading from the west to the east of Germany, coinciding with an expansion in the same direction of peach cultivation [see below, p. 268].

Blunck has pointed to an increase of wheat foot rots [*Ophiobolus graminis*, *O. herpotrichus*, *Cercosporella herpotrichoides*, and *Fusarium* spp.: *R.A.M.*, xiii, p. 153], and inappropriate manuring schemes (such as those resulting in the insolubilization of boron and consequent development of heart and dry rot of beets [ibid., xviii, p. 428]), have largely contributed to the occurrence and extension of many diseases.

The actual number of plant diseases and pests has risen during the last century. This increase is not only an apparent one, due to the closer study of phytopathology, but cultivated plants have definitely been colonized by new parasites formerly found only on weeds, e.g., *Synchytrium endobioticum*, unknown in the country of origin of the potato, was presumably an unrecognized inhabitant of wild Solanaceae in Great Britain, where it spread to the cultivated crop in the seventies of the last century; in North America, *Pseudoperonospora cubensis*, originating on wild Cucurbitaceae in South America, migrated to the cucumber and vegetable marrow, while *P. humuli* passed from wild to cultivated hops. Increased commerce in plants has led to the introduction of pathogens into countries formerly free from them.

Another vital question remains: has the virulence of the parasites or the suscepti-

bility of the hosts increased? Although some well-known examples of variations in the aggressiveness of the different physiologic races of certain fungi could be cited in support of the former hypothesis, convincing evidence is not forthcoming. At the same time, the work of plant-breeding during the past two decades has been directed, in many cases with conspicuous success, towards a combination of disease resistance with heavy cropping. There is thus no question of any general increase in the susceptibility of plants to disease, but the viruses constitute a very serious exception to this rule, the absolute figure for diseases of this type having risen substantially. Speculation is rife as to the nature and etiology of the viruses, but the one positive fact is their multiplication in such an alarming fashion that their control constitutes the foremost phytopathological, or one may even say biological, problem of the day.

KLINKOWSKI (M.). **Pflanzenpathologie im Ostland. I. Mitteilung. Aufgaben der Pflanzenpathologie und des praktischen Pflanzenschutzes im baltischen Ostland.** [Phytopathology in the Ostland. Note I. Tasks of phytopathology and practical plant protection in the Baltic Ostland.]—*Z. PflKrankh.*, liii, 1–3, pp. 12–18, 1943.

The 'Ostland, an entirely new political conception', comprises the Baltic Provinces of Estonia, Latvia, and Lithuania, and White Ruthenia, of which the first three constitute an agricultural unit, while the last-named calls for the application of different standards and is reserved for future discussion. The phytopathological administration of the Baltic provinces has now become a function of the Reich Commissariat, and the writer was appointed in 1941 to study the position and requirements of the different regions concerned. Briefly to sum up the information thus acquired, it may be stated that in Lithuania both research and practical plant disease control are still in a rudimentary state, commanding next to no interest in agricultural circles, while in Latvia very considerable progress has been made during the last two decades, more especially in the practical problems of disease control. In Estonia, however, the practical application of the noteworthy results attained in scientific studies at the University of Dorpat has proved less feasible than in Latvia.

One of the foremost tasks to be undertaken by the newly constituted authorities is the development of a plant protection warning service under uniform organization. Such services already exist in Latvia and Estonia, but not in Lithuania. The preliminary steps towards the realization of this project have already been taken. Another urgent necessity is the installation of facilities for seed-cleansing and treatment, more especially the former, which are practically unknown, for instance, over wide tracts of eastern Latvia. The importance of seed-grain disinfection is recognized in Latvia, and to a lesser extent in Estonia, whereas Lithuania, the largest of the Baltic Provinces, is the most backward in this respect, copper sulphate or formalin being mainly used where treatment is carried out at all and the annual consumption of up-to-date preparations amounting to less than a ton; only 14 seed-disinfection machines were found in the whole country, so that no idea of introducing large-scale dusting can be entertained for the time being.

The survival of the rye crop through the winter in many parts of the Provinces depends less on 'winter injury' than on the development of the snow mould [*Calonectria graminicola*]. Loose smuts of wheat and oats [*Ustilago tritici* and *U. avenae*] may also be responsible for heavy losses, amounting in eastern Latvia in 1941 to 20 per cent., while both diseases were prevalent in 1942. A mobile co-operative seed-treating installation is shortly to be set up in this district.

Flax is extensively cultivated in the 'Ostland' and the treatment of the seed, in the first place against the destructive *Colletotrichum lini* and secondly against *Fusarium lini*, is another important development of the future. The Provinces are

conceived as large-scale providers of fodder-clover and grass seeds for the German 'living-space', and in this connexion attention is drawn to the need for combating *Sclerotinia trifoliorum* and *Gloeosporium caulivorum* [*Kabatiella caulivora*] among other seed-borne disease.

The 'Ostland' is further expected to serve as a source of seed potatoes for the 'living-space' of the U.S.S.R. and other parts of Europe. Latvia and Estonia had already found markets for their produce before the war, both in Europe and overseas, the absence of wart disease [*Synchytrium endobioticum*] from these countries being one of the factors enabling them to compete successfully against Germany, Holland, and Poland. The pathogen does occur, however, both in Lithuania proper and in the former Polish territory ceded to Lithuania, two local foci of infection having been detected. Of much greater importance than wart disease from the angle of seed potato production are the viruses, which have hitherto been reported to be of no account in the Baltic Provinces. This was also the writer's impression from an inspection, during the Russian campaign of 1941, of the potato fields of Lithuania, eastern Latvia, and the territory of the U.S.S.R. as far as Lake Ilmen, but he has formed another opinion since taking up residence in the 'Ostland' and visiting different regions. The lack of experts on virus diseases is a great obstacle to the development of seed potato production in the Provinces along the projected lines, but it is hoped that this may shortly be overcome. Late blight (*Phytophthora infestans*) exacts a heavy toll of the potato crops, especially in Estonia and Latvia, where spraying with Bordeaux mixture has hitherto been virtually confined to the experiment stations. For the present the shortage of copper and machinery does not permit of any great advance in the control of this disease, but it is one of the matters requiring attention later. Other potato pathogens of relatively frequent occurrence are *Bacillus phytophthorus* [*Erwinia phytophthora*], *Alternaria solani*, and *Cercospora concors*.

Sugar beets are grown only in Latvia and Lithuania. In the former, where the area under the crop comprises 20,000 ha., plant disease control measures were applied annually over an average acreage of 1,500 to 2,500 ha., of which 1,000 to 2,000 were destroyed by heart and dry rot; preparations for combating this disorder are on sale at the sugar factories. *Cercospora beticola* is assuming increasing severity, causing such heavy damage in some seasons as to threaten the further cultivation of the crop.

KIRULIS (A.). **Die mikroskopischen Pilze als natürliche Feinde der Pflanzenkrankheiten in Lettland.** [The microscopic fungi as natural enemies of plant diseases in Latvia.]—*Arb. landw. Akad. Mitau*, i, pp. 479–536, 1942. [Abs. in *Z. PflKrankh.*, lii, 12, p. 549, 1942.]

The writer's studies in the very imperfectly explored field of hyperparasitism among fungi revealed the existence of true parasites chiefly in the genera *Cicinnobolus*, *Darluca*, and *Tuberculina*, of facultative parasites in *Cladosporium* and *Fusarium*, and of symbionts, commensals, and the like in *Ramularia*. Up to the present 23 members of the Erysiphaceae have been recorded as hosts of *Cicinnobolus cesatii* [*R.A.M.*, xviii, p. 803]. *Darluca filum* attacks not only 71 rusts [ibid., xxi, pp. 472, 493] but a large number of other species. *Pseudogloeosporium rubi* lives at the expense of *Phragmidium*, *Barbarosporina rhytismatis* n. sp. at that of *Rhytisma salicinum*, *Gloeosporium roseolum* in the fruit bodies of *Melasmia acerina* and on *R. symmetricum*, *Ramularia coleosporii* is a non-parasitic symbiont of four rusts, while three facultative parasites, viz., *Cladosporium aecidiicola*, *C. exobasidii*, and *C. exoasci* inhabit, respectively, Pucciniaceae and Melampsoraceae, Exobasidieae, and *Taphrina pruni*. *Rhytisma salicinum* and *R. symmetricum* also serve as hosts of *Columnophora rhytismatis* (Bres.) Bub. & Vleug. *Tuberculina persicina* [ibid., xix, p. 730] parasitizes numerous rusts, *Hymenula spermogoniopsis*

is a commensal of *Triphragmium*, *Puccinia*, and *Melampsora*, while three facultatively parasitic species of *Fusarium*, i.e., *F. avenaceum*, *F. heterosporum*, and *F. poae*, are found, respectively, on rusts and *Claviceps purpurea*, rusts and smuts, and smuts.

FUCHS (W. H.). **Hochschulausbildung in Phytopathologie und Pflanzenschutz.** [College education in phytopathology and plant protection.]—*Z. PflKrankh.*, liii., 1–3, pp. 107–113, 1943.

Assuming that phytopathology and plant protection will enter largely into the solution of the problems connected with agricultural self-sufficiency in the post-war European economy, the writer outlines his plans for the training of students in these subjects [*R.A.M.*, xxi, p. 465]. Phytopathology and plant protection are distinguished from each other and compared with the scientific and clinical aspects of medicine, respectively, the former being concerned in a general way with the symptomatology, anatomy, and physiology of infected plants and the etiology of disease, the epidemiology of parasites and theoretical plant-protective therapy, and the latter with the practical applications of these studies to the disorders of particular economic crops and their control by cultural methods and disinfectant treatments. Some proposals for the readjustment of the college curriculum to meet these requirements are made.

WOODS (M. W.). **Respiration and virus diseases.**—*Chron. bot.*, vii, 6, pp. 243–244, 1942.

After briefly summarizing the literature on respirational problems connected with virus diseases of plants, the author attributes the conflicting results frequently obtained by various workers to differences in methods and techniques used, and suggests that the application of half-leaf comparison technique and micro methods will eliminate many of the variable factors which make the interpretation of results difficult at present.

THOMAS (W. D.). **Mycorrhizae associated with some Colorado flora.**—*Phytopathology*, xxxiii, 2, pp. 144–149, 1 fig., 1943.

A tabulated account is given of the writer's studies on the mycorrhiza of Colorado flora in 1939 and 1940 [*R.A.M.*, xxi, p. 313]. The ectotrophic form developed only on trees and shrubs, the coralloid type predominating; it was found on pines (*Pinus contorta*, *P. flexilis*, and *P. ponderosa*), spruce (*Picea pungens*), *Pseudotsuga taxifolia*, *Abies concolor*, junipers (*Juniperus scopulorum*, *J. virginiana*, and *J. communis*), poplars (*Populus deltoides* and *P. tremuloides*), oak (*Quercus utahensis*), elm (*Ulmus americana*), *Celtis occidentalis*, *Prunus americana*, *P. pennsylvanica*, and *P. virginiana*, while the ball type was confined to *Salix scouleriana*, birch (*Betula fontinalis*), and alder (*Alnus tenuifolia*).

Ectendotrophic mycorrhiza were observed only on six species, viz., *Picea engelmanni*, *Prunus virginiana*, ash (*Fraxinus pennsylvanica*), *Robinia pseudacacia*, *Gleditsia triacanthos*, and *Cercocarpus montanus*.

Of the three types of endotrophic mycorrhiza, namely, peloton, arbuscule, and vesicle, the first-named was the most common, among its 21 hosts being *Gentiana elegans*, *Pentstemon secundiflorus*, and *Delphinium subalpinum*; vesicles were harboured by 17, including lucerne, *Ribes saximontanum*, and two species of *Vaccinium*, and arbuscules by seven, among them *Rudbeckia hirta*. No true endotrophic mycorrhiza were detected in tree or shrub roots.

The hosts of pseudomycorrhiza were *Pinus contorta*, *P. flexilis*, *P. ponderosa*, *Picea pungens*, *P. engelmanni*, *Pseudotsuga taxifolia*, *Juniperus scopulorum*, *J. virginiana*, *Gleditsia triacanthos*, elm, *Prunus americana*, and *P. pennsylvanica*.

BJÖRKMAN (E.). **Mykorrhizans utbildning och frekvens hos skogsträd på askgödslade och ogödslade delar av dikad myr.** [The development and incidence of mycorrhiza among forest trees on ash-fertilized and unfertilized sectors of drained marshes.]—*Medd. Skogsförsöksanst., Stockh.*, 32, pp. 255–296, 19 figs., 1941. [German summary.]

Following a survey of the ecological relationships of the marshes of Västerbotten, Sweden, drained in 1910, the author fully describes and tabulates the various types of mycorrhiza encountered in 1939 and 1940 among the stands of spruce, pine, and birch, which were very sparse, with correspondingly poor mycorrhizal development, except where wood ash had been applied in 1918 and 1926 at the approximate rates of 3,300 and 12,500 kg. per ha., respectively. Types A, B, C, and D, the last-named comprising Da and Dn (*Mycelium r[adicis] atrovirens* and *M. r. nigrostrigosum*, respectively) [*R.A.M.*, xix, p. 423], were all represented on the conifers: the birch roots were covered with a dense coil of elongated short-root branches of the monopodial type, provided with a whitish-grey hyphal mantle and strands, presumably identical with the formation designated by Melin in Malmström's preliminary report on a limited amount of material from the same locality (*Medd. Skogsförsöksanst., Stockh.*, 28, 1935) as an aberrant form of A.

The following higher fungi were observed in the birch woods of the fertilized sectors in the southern portion of the marshes in association with *Polytrichum*: *Boletus scaber*, *Collybia confluens*, *C. dryophila*, *Entoloma rhodopolium*, *Lactarius trivialis*, and *Paxillus involutus*. In the untreated sectors the fruit bodies of this group of fungi were much scantier except among pines in the *Andromeda polifolia* association on the borders of the marshes, where *B.* spp., in particular are often to be found. Where *Molinia coerulea* flourishes *B. scaber*, *L. rufus*, and *P. involutus* are fairly common. In the northern area of the moorlands (*Deschampsia caespitosa* and *Calamagrostis purpurea* association), the following organisms were present on the fertilized sectors, though in very small numbers as compared with the incidence in the southern region. *B. scaber*, *Clitocybe candicans*, *C. agathiformis*, *Collybia confluens*, *C. dryophila*, *Cortinarius* sp., *Hebeloma* sp., *Hygrophorus miniatus*, *Inocybe lacera*, *Laccaria laccata*, *Lactarius glyciosmus*, *L. torminosus*, *Lepiota amianthina*, *Lycoperdon piriforme*, *Omphalia umbellifera*, *Peziza badia*, *Thelephora terrestris*, and *Tricholoma grammopodium*.

WAKSMAN (S. A.) & HORNING (E [LIZABETH] S.). **Distribution of antagonistic fungi in nature and their antibiotic action.**—*Mycologia*, xxxv, 1, pp. 47–65, 1 fig., 2 graphs, 1943.

In a study of antagonistic fungi in soil and other natural substrata the following methods of isolation were developed: (1) agar plates seeded with various bacteria were inoculated after 12 to 24 hours with small particles of soil or manure, and (2) washed suspensions of different living bacteria were added to washed agar containing a carbohydrate and some phosphate, and this bacterial agar used for plating out the soil or the manure. The following slight modification of the second method was most frequently used: two- to three-day-old cultures of *Bacillus subtilis*, *Sarcina lutea*, *Staphylococcus aureus*, and *Escherichia coli* grown on agar or on liquid media were suspended in sterile water, centrifuged, washed, again centrifuged, and then added to washed agar containing 1 to 3 per cent. glucose and 0·05 to 0·1 per cent. potassium dihydrogen phosphate, the slightly acid reaction of the medium making it highly favourable for the development of antagonistic fungi. The soil or manure was plated out on this agar in dilutions of 1 : 500, 1 : 2,000, and 1 : 10,000, and the plates incubated for two to four days at 25° to 28° C. Bits of mycelium were later transferred to plates of sterile glucose and glucose-peptone agar and replated, when necessary, to obtain pure cultures. Only such cultures were selected for study as showed a clear zone between the colony of the fungus

and that of the test bacteria. The most satisfactory method of determining the antibiotic activity of antagonistic fungi, tested in liquid media, was to incorporate varying amounts of the fungal filtrates into nutrient agar and to streak the plates with two to four test bacteria. Positive or negative growth of these test organisms gave the limit of activity or the concentration of the active substance in the filtrate. The time of incubation varied with different test organisms from two to five or more days; in most cases the activity remained unimpaired by continued incubation, but sometimes it was reduced or completely stopped after an additional day or two. This is taken to indicate that in some fungi either the active substance is destroyed by prolonged incubation or that the test organism becomes adapted to the substance, while certain other fungi seem to produce substances that remain active for only a short time.

The antagonistic fungi isolated in the present study fall into nine distinct taxonomic groups: (1) the *Chaetomium* group, comprising one strain; (2) the *Aspergillus fumigatus* group, 15 strains; (3) the *A. clavatus* and *A. glaucus* groups, two strains of the former, and one of the latter (4) the *A. flavus* group, one strain; (5) the *Penicillium luteum-purpurogenum* group, 20 strains; (6) the green *Penicillium* group, 21 strains and the highly active *P. notatum*; (7) the *Trichoderma* group, two strains; (8) the *Fusarium* and *Cephalosporium* group, 15 strains; and (9) a miscellaneous group, comprising strains either incompletely identified or insufficiently studied. The various fungi were found to differ markedly in activity; some produced antibiotic substances which could readily be isolated from the medium, while with others, extraction or adsorption methods gave unsatisfactory results. Some of the fungi (e.g., *P. notatum*) were found to comprise strains, even among those isolated from the same mother culture, varying considerably in their antibiotic activity. It appeared that nutrition has an important influence on the production of antibiotic substances of *P. notatum*: the presence of iron increased the general activity of the culture as well as the special one against *E. coli*, while zinc, even in a concentration of 10 mg. zinc sulphate per l. greatly reduced the general activity and completely repressed the activity against *E. coli*, and manganese had little effect. Another factor was volume of medium: some fungi were more active when grown in deep and others when in shallow layers. Temperature at incubation was in most cases optimal at 28° or lower, but many fungi grew well at 37° and even 50°. Some fungi produced the antibiotic substance after two to five days of incubation, while others required a longer period. In the case of *P. notatum*, the substance active against *E. coli* appeared after two to four days and disappeared rapidly, while substances active against other bacteria began to appear later. An antibiotic substance, tentatively designated fumigacin [*R.A.M.*, xxii, p. 91], was isolated from fungi of the *A. fumigatus* group. The substance is soluble in chloroform and alcohol and partly soluble in ether and water; it is thermolabile in the culture filtrate, but becomes more thermostable after concentration. The substance was more active against *B. mycoides* than against *B. subtilis*, this being the reverse of the effect of other antibiotic substances tested against these two organisms.

Brodski (A. L.). **Antagonism between soil infusoria and [plant] pathogenic fungi.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxxiii, pp. 81–83, 1941. [Abs. in *Brit. chem. Abstr.*, A, III, *1943*, p. 275, 1943.]

In artificial media the mycelium of *Verticillium dahliae* makes no growth in the presence of *Culpoda*, and its pseudosclerotia fail to germinate, a similar but much weaker action on the fungus being exerted by *Bacillus mesentericus* and *Bacterium* [*Pseudomonas*] *fluorescens*. Tomato plants grown in aqueous media to which pseudospores of *V. dahliae* are added develop wilt symptoms after bud formation, whereas no sign of infection appears on the flowers or fruit of plants in comparable cultures containing the infusoria in an active form. In wilt-infested soil the

incorporation of *Culpoda* materially lowers the incidence of diseased plants and substantially increases yields.

KLAPP (E.). **Arbeiten zur praktischen Bekämpfung des Kartoffelabbaus.** [Investigation on the practical control of Potato degeneration.]—*Forschungsdienst, Sonderh.* 16, pp. 370–377, 1942. [Abs. in *Z. PflKrankh.*, lii, 12, pp. 544–545, 1942].

This is a report on the investigations carried out from 1938 to 1941 by the members of various agricultural and plant-breeding associations, in co-operation with the Bonn Institute of Soil Science and Agriculture, on the practical possibilities of combating potato degeneration. In the Bonn experiments, the relative yields of several ordinary commercial varieties, reckoning 100 per cent. for the original selected stock, were 38·4, 22·8, 19·5, and 15·2 per cent. for the first, second, third, and fourth successive crops, respectively, the reductions for the officially approved varieties (first and second successions) being to 72·9 and 46·7 per cent., respectively, while the corresponding disease percentages rose from 13·9 per cent. in the original selected stock to 50·3 and 74·7 per cent. in the first and second following crops, respectively. Thus, even the best seed stocks in the 'degeneration areas' of western Germany are likely to comprise only 25 per cent. healthy plants after the second successive cropping and to produce less than half the quantity secured from the original selected material. Among the comparatively resistant or tolerant varieties are Ostbote, Mittelfrühe, Roland I, Flava, and Ackersegen.

In tests to determine the radius of infection, a decrease of 24 per cent. occurred between the focus of disease and the tenth row, beyond which the decline was only slight. The yield of the succeeding crop increased by 45 per cent. over the same radius. In the direction of the prevailing wind the portion of the stand behind the centre of infection is in greater danger of attack than that in front of it. The beneficial effects of the selection of healthy plants for the provision of 'seed' was confirmed. Early harvesting resulted in an up to 49 per cent. heavier yield and 92 per cent. less disease, but tubers lifted before maturity do not keep well and are physiologically inferior. An effect comparable to that produced by early lifting was secured by cauterizing the stands with powdered kainit or raphanit, the use of a poisonous spray, such as cresol-fruit tree carbolineum, or removal of the foliage by cutting. Normal planting distances gave the best results. The application of nicotine sprays led to large increases of yield during the current season through the reduction of aphid injury, but even weekly treatments failed to protect succeeding crops.

Köhler's method of testing cuttings as an index to the value of the seed stocks from the point of view of degeneration has been adopted at a number of plant-breeding stations, and is thought to be the best procedure yet devised for this purpose. *Myzus persicae* remains the sole vector of any importance in the transmission of potato degeneration diseases, hence the distribution of the latter coincides, generally speaking, with that of intensive peach cultivation [*R.A.M.*, xx, p. 487].

KLAPP (E.). **Einflüsse der Düngung mit und ohne Virusschutz auf den Pflanzwert der Kartoffel.** [The effects of manuring with and without virus protection on the value of Potatoes for seed.]—*Z. PflKrankh.*, liii, 1–3, pp. 25–36, 1 fig., 1943.

At the Bonn-Poppelsdorf Experiment Station, in order to determine the effects (both direct and in relation to virus diseases) of different manuring schemes on the value of potatoes for seed, medium-early plants of healthy stock were grown in boxes of 90 to 100 kg. capacity sunk into the soil (three per box, five replications), the Eigenheimer variety being used in 1939 and a first-class selection of Flava and

Böhm's Mittelfrühe in 1940 and 1941, respectively, under the following conditions. One section (A) was left to grow without protection, a second (B) covered with muslin stretched over a wooden framework and sprayed with nicotine to exclude aphids, and a third (C) similarly shielded but exposed at frequent intervals to infestation by *Myzodes* [*Myzus*] *persicae* [see preceding abstract]. Nitrogen, potassium, and phosphorus were applied in seven combinations, the two former at the rate of 10, and the last-named at that of 5 gm. per box.

Taking the three-year series of experiments as a whole the weighted average increase of second-year yields due to protection against viruses was 32·9 per cent., while artificial infestation by *M. persicae* caused reductions of 31·8 and 9·5 per cent., respectively, as compared with the protected and random-infection plots. Nitrogen deficiency was responsible for the maximum injury to the crops, both with and without virus infection. In section (A) the omission of potash from the fertilizer resulted in the heaviest yields, whereas in (B) and (C) a complete fertilizer in various combinations gave higher yields than the omission of any one element. As regards virus protection, there was no essential difference between ammonia and saltpetre, though the latter appeared to be slightly superior on a two-year average in section (A). Urea, which exerted a not unfavourable effect in (A), was distinctly less advantageous in (B). Potassium sulphate magnesia was more beneficial in (A) than the 40 per cent. salt, but less so in (B) and (C).

The most conspicuous diseases in the second-year crops were various types of mosaic, streak necroses, and virulent mixed infections.

Younkin (S. G.). **Purple-top wilt of Potatoes caused by the Aster yellows virus.**—Abs. in *Phytopathology*, xxxiii, 1, p. 16, 1943.

Evidence is submitted for the possible implication of the eastern strain of the aster yellows virus [*R.A.M.*, xxii, p. 206] in the causation of purple-top wilt of potatoes [ibid,. xvii, p. 700; xxii, p. 221]. *Macrosteles divisus* was shown by extensive tests to convey a strain of the aster yellows virus from naturally infected *Ambrosia artemisiifolia* to potato, inducing purple-top symptoms typical of those observed in the field. From preliminary trials it appears that insect number may be a limiting factor in the effective transmission of the virus to potatoes. Thus, in the case of insect populations with a minimum of 95 per cent. infective individuals, ten insects per plant resulted in a significantly higher incidence of infection than five, whereas 20 were of no more use than ten. In greenhouse tests, Green Mountain was less susceptible to the wilt than Katahdin and Smooth Rural. In four out of 200 grafts on *Nicotiana rustica* with scions from spontaneously infected Katahdin, Sebago, Rural, and Cobbler potato plants from 18 localities in New York and Pennsylvania, transmission of the virus was effected, the symptoms of all four strains on *N. rustica* being identical, but distinct from those induced by the *Ambrosia* strain. On asters [*Callistephus chinensis*] all strains of the virus seemed to produce similar effects.

Walters (S. W.). **Production of seed Potatoes.**—*Fmg S. Afr.*, xviii, 204, pp. 139–142, 148, 2 figs., 1943.

Brief notes in popular terms, designed to assist South African seed potato-growers, are given on selection, sprouting, methods of cultivation, and the prevention of virus diseases.

Bald (J. G.) & White (N. H.). **Potato virus X: the average severity of strain mixtures in three varieties of Potato.**—*J. Coun. sci. industr. Res. Aust.*, xv, 4, pp. 300–306, 1 graph, 1942.

The average severity of mixtures of strains of potato virus X [*R.A.M.*, xx, p. 220] in potato varieties was studied in Early Carman, Late Carman, Western

Australian, Delaware, and Tasmanian Brownell, the severity of the strains carried being assessed by the symptoms produced in *Datura stramonium*.

The tubers to be tested were numbered and set out on a tray, and 6-in. pots, each containing two or three *D. stramonium* seedlings at the two-leaf stage, were placed on the bench. A piece of sandpaper 1½ in. sq. was placed on a piece of plain paper about 6 in. sq., and the pot label was used to hold the paper and sandpaper firm. The skin on a corner of a tuber was broken and the dirt removed by drawing the tuber across the paper, after which the exposed surface was lacerated by rubbing on the sandpaper. One to several drops of dilute phosphate buffer solution (about M/200 at P_H 7) were allowed to fall on the exposed surface, and the tuber was then drawn across the leaves of the *D. stramonium* seedlings in one pot, which had previously been dusted with carborundum powder. The leaves were then sprayed with water. One hundred per cent. infection usually resulted. When the symptoms had developed fully, they were rated according to mottle and degree of necrosis, and plants without symptoms were inoculated with a necrotic strain of virus X to ascertain if they carried a masked strain or were free from infection.

In the first experiment, the mean ratings for Early and Late Carman were 2·68 and 2·64, respectively. From this it is concluded that the two types carried almost identical virus mixtures.

In experiments with the three varieties the mean ratings for Delaware were 2·11 and 2·32 (from selected and certified stock, respectively), for Carman 2·57 and 2·68 (Early and Late, respectively), and for Brownell 3·19, which showed that these three varieties carry virus mixtures which differ considerably in severity. The ratings for Early and Late Carman are not significantly different, but those for the two lots of Delaware are. As has already been found with Up-to-Date (in work not yet published), single plant selections of Delaware made on a basis of vigour and relative freedom from mottle were found to reduce the proportion of plants carrying the severer strain mixtures of virus X, the frequency of ratings of 0·1 to 1·0, 1·1 to 2·0, 2·1 to 3·0, and 3·1 to 4·0 in selected and certified stock being 11, 15, 16, and 0, respectively, and other experiments gave similar results.

In explanation of these findings the authors put forward the hypothesis that a natural equilibrium exists between strains of the virus for each variety. It is pointed out that mixtures containing predominantly mild strains with a small admixture of the ring spot and necrotic strains do not remain constant when repeatedly subcultured on susceptible hosts. The more severe strains often multiply at the expense of the milder ones, and the average severity of the mixture increases. In extreme cases, a limit to the multiplication of a severe strain is imposed by the damage it does to the host tissues. For instance, in potato varieties, on which the necrotic strain of virus X causes a fully necrotic reaction, it can barely, if at all, persist in the pure state, as it kills the sites for its own multiplication. It can persist in mixtures with milder strains producing mottle or a partial necrosis. By extension of this principle, the limit set to virus multiplication is inversely related to injury effected to the host tissues. Mild strains may never reach this limit. A mixture of mild and severe strains in a susceptible host will usually approach an equilibrium represented by the balance of two opposing tendencies. Such a hypothesis provides a likely explanation for the occurrence of similar populations of virus mixtures in long separated families of the same potato variety. As different varieties react differently to strains of virus X, it may be assumed that they carry the strain in different proportions, and that the average severity of strain mixtures is correspondingly affected. The effect on yield is probably the controlling factor limiting the multiplication of severe strains, while the partial segregation of mild strains in some tuber lines or families, which thus become higher-yielding, would be counterbalanced by the gradual emergence of severe strains, at first present in traces.

Recent work at Canberra suggests that the masked strain may not give complete protection against severe strains of virus X, and proof has been obtained that it can cause a 12 per cent. loss of yield. Therefore, the loss from even such a mild infection and the risk that infiltration of severer strains may occur must be balanced against the ease and cheapness of controlling greater losses by founding and maintaining stocks carrying a masked strain. In any case, regular, periodical selections from the parent stock to prevent a drift towards higher concentrations of severe strains and lower yields are to be recommended.

Kranitz (F. A.), Tolaas (A. G.), Werner (H. O.), Goss (H. W.), & Jensen (J. H.). **The Kasota Potato.**—*Amer. Potato J.*, xx, 2, pp. 25–27, 1943.

Particulars are given of the Kasota potato (hybrid B5), which in five out of the six years of varietal testing for resistance to *Fusarium solani* var. *eumartii* in Nebraska [*R.A.M.*, xxi, p. 39], produced only one-third as many tubers with stem-end rot and vascular discoloration as Triumph and Cobbler. It is equally susceptible with Triumph to scab [*Actinomyces scabies*], but the pustules were rarely of the deep or pitted type. Its reactions to spindle tuber were comparable to those of other commercial varieties in Nebraska. Observations in Minnesota indicate that Kasota may be rather less susceptible to late blight [*Phytophthora infestans*] than the commonly grown varieties.

Snell (K.) & Geyer (H.). **Die zugelassenen deutschen Kartoffelsorten, ihre Erkennung, Unterscheidung und wirtschaftliche Bedeutung. 7. Aufl.** [The approved German Potato varieties, their recognition, differentiation, and economic importance. Seventh edition.] 91 pp., 35 figs., Berlin, P. Parey, 1942. Single chart RM.1.90. [Abs. in *Z. PflKrankh.*, lii, 12, p. 541, 1942.]

Included in the five German potato varieties officially approved in 1942 are two [unspecified in the abstract] resistant to the widespread biotype A of *Phytophthora infestans* [*R.A.M.*, xxii, p. 108], bringing the total number of sorts capable of withstanding late blight to five. In the case of each of the recognized varieties, its behaviour as regards 'degeneration' and reactions to 'Eisenfleckigkeit' and scab [*Actinomyces scabies*] are also indicated. Virtually immune from the last-named disease are Ackersegen, Carnea, Jubel, and Weisses Rössl, fairly resistant Edelragis, Erdgold, and Spätrot, and moderately susceptible Altgold, Centifolia, Frühbote, Konsuragis, Lichtblick, and Optima.

Dippenaar (B. J.). **Common scab, brown rot, and internal brown fleck of Potatoes.**—*Fmg S. Afr.*, xviii, 204, pp. 213–218, 4 figs., 1943.

A brief account is given in popular terms of the symptoms and control of potato scab (*Actinomyces scabies*) [*R.A.M.*, xx, p. 380], brown rot or bacterial wilt (*Phytomonas* [*Bacterium*] *solanacearum*) [ibid., xx, p. 194], and internal brown fleck [ibid., xix, p. 585]. Against scab, disinfection with mercuric chloride (2 oz. in 12½ gals. for one hour), formalin (1 pt. in 30 gals. for two hours), or aretan (½ minute) is recommended. Lime or ash should not be applied to soils with a P_H value of 5·2 or more and heavy applications of kraal manure may exert the same effect as lime. In a soil comparatively free from infection but with a P_H value exceeding 5·4 the planting of potatoes at intervals of two or three years is advised.

Control measures against *Bact. solanacearum* include the use of healthy seed, avoidance of cutting tubers when the stock is at all infected, avoidance of infected soil, roguing out of wilted plants if only isolated plants are affected in the field, and the application of sulphur (under specified recommendation from the nearest College of Agriculture) to reduce the P_H value to 4·0 or lower, since the bacteria quickly die out under this condition.

Internal brown fleck is not infectious and it is perfectly safe to plant affected

seed potatoes, provided the condition is not so severe as to affect the greater part of the flesh. The condition is of frequent occurrence in western Cape Province, sometimes in soils with P_H 6·8, i.e., soils not needing liming. Potatoes ripening in summer are very susceptible, and the disease is more prevalent on loam than on clay soils. Dunbar Standard is highly susceptible, but 40 to 50 per cent. occurrence has been observed in Arran Banner. In one instance, Dunbar Standard and King George, side by side, showed 50 and 0 per cent. incidence, respectively, though on other occasions the latter variety has been slightly affected.

Cook (H. T.) & Nugent (T. J.). **Potato scab in relation to calcium, soil reaction, and the use of acid-forming and non-acid-forming fertilizers.**—*Bull. Va Truck Exp. Sta.* 108, pp. 1785–1795, 1942.

Experiments carried out at Onley, Virginia, from 1938 to 1941, inclusive, to determine the effect of acid-forming and non-acid-forming fertilizers on the occurrence and severity of potato scab [*Actinomyces scabies*: *R.A.M.*, xviii, p. 475; xxii, p. 151] are described. Thirty-eight plots were used, each having received one of six different kinds of lime for five years. The soil was a sassafras sandy loam grading into a Keyport sandy loam, and the organic content averaged about 2·8 per cent., while the P_H values ranged from 4·5 to 5·4. The plots were divided longitudinally for the acid-forming and non-acid-forming fertilizer tests. The acid-forming fertilizer was applied to three rows on one side of the plot, and similar fertilizer neutralized with dolomitic limestone was applied to three rows on the other. In 1941, gypsum was applied to one row of every plot at the rate of 1,000 lb. per acre to determine whether increasing the calcium content of the soil without changing the reaction would increase scab.

The results obtained demonstrated that in all years except 1938 significantly more scab developed on the potatoes from the plots treated with non-acid-forming fertilizers than on those from plots treated with acid-forming fertilizers. This is explained by the fact that most of the soil samples from the acid-forming fertilizer plots had soil reactions unfavourable to scab, while most of the samples from the non-acid-forming fertilizer plots had reactions favouring the fungus.

When the data were divided according to soil reaction irrespective of the fertilizer used, there was significantly more scab on the potatoes from the sections with the higher soil reactions than on those from the sections with the lower soil reactions in all four years. This relationship was found when the samples from both the acid-forming and non-acid-forming fertilizer plots were analysed together, and when the samples from the plots treated with each kind of fertilizer were analysed separately.

Analysis of the data further showed that the addition of extra calcium caused no important change in soil reaction and no significant differences in the amount of scab present, with either acid-forming or non-acid-forming fertilizers.

It is concluded that the amount of scab present on potatoes is closely correlated with soil reaction, and only indirectly correlated with the fertilizer reaction or calcium content of the fertilizer in so far as the fertilizer changes the soil reaction. Calcium itself has no effect on scab development, and calcium compounds affect it only to the extent that they change the soil reaction.

Growers are advised to use a non-acid-forming fertilizer on soils the P_H value of which is 5 to 5·2 or under. Soils with P_H below 5 to 5·2 should also be limed sufficiently to bring the reaction to that level. On soils with reactions over P_H 5 to 5·2 acid-forming fertilizers should be used. Soils with P_H much above 5·2 which have previously produced infected potatoes should be planted to a different crop until the reaction has been reduced to P_H 5 to 5·2 by the continued application of acid-forming fertilizers for a number of years.

Braun (H.). **Biologische Spezialisierung bei Synchytrium endobioticum (Schilb.) Perc. (Vorläufige Mitteilung).** [Biological specialization in *Synchytrium endobioticum* (Schilb.) Perc. (Preliminary note).]—*Z. PflKrankh.*, lii, 11, pp. 481–486, 2 figs., 1942.

In August, 1941, a sample of potato tubers was submitted for inspection to the Biological Institute, Dahlem, Berlin, by the Thuringian Plant Protection Station, from a field reported to be totally infected by wart disease (*Synchytrium endobioticum*). Since the material was too extensively rotted by *Phytophthora infestans* to permit of a reliable identification of the variety concerned (alleged to be the wart-immune Ostbote), a local investigation of the affected area was carried out by an experienced member of the Institute staff. The stand was found, in fact, to consist mainly of the variety in question, with an admixture of Ackersegen, Prisca, and (?) Edda, the two former being free from the disease, while the last-named was severely attacked. In preliminary laboratory tests inoculation experiments with the Thuringian isolate of the fungus (designated G from the name of the locality of origin, Giessübel) gave positive results both on Ostbote and Edda, whereas the Dahlem strain (D), hitherto used for official varietal tests, caused no infection.

The existence of physiologic specialization in *S. endobioticum* being thus established in principle, further trials were conducted in the winter of 1941–2 with the new biotype on 67 varieties definitively or provisionally recognized as wart-immune. Of these, 58 proved to be susceptible and a further seven probably so, leaving only two resistant, namely, Fram and Frühe Hörnchen, both of which will of course require extended tests to confirm their presumed immunity. Of another 40 varieties, hitherto regarded as immune, but excluded from the seed-potato trade by the regulations of the Reich Food Board, 37 proved to be susceptible to race G, while Edelrot, Hellena, and Treff As presented some indications of resistance. Of 53 selections from the Kaiser Wilhelm Plant Breeding Institute, Müncheberg, 12 appeared to be resistant to the new race, but here again further experiments will be necessary finally to establish their reactions. Exactly twice this number were resistant to race D, in which connexion it should be noted that, whereas G is capable of attacking varieties resistant to D, the converse does not hold good, all those resistant to D in the present series of experiments having been found susceptible to G. The high degree of aggressiveness of the new biotype as compared with the original one is thus amply apparent.

The range of physiologic specialization within *S. endobioticum* is not, however, exhausted by biotypes D and G, a third one (SB) being represented in material received from [C.] Blattný and originating in southern Bohemia (Czechoslovakia). Of 66 recognized German varieties inoculated with this race, 32 were immune (again including Fram and Frühe Hörnchen), 13 and 7 were unmistakably and probably susceptible, respectively, while the remaining 14 may be ranked as 'border-line' varieties. A table is given showing the reactions of seven varieties to the three biotypes of *S. endobioticum* under discussion. Fram is immune from all three, Edda, Edelragis, and Parnassia susceptible to G but immune from SB and D, while Primula, Sabina, and Sickingen are susceptible to G and SB but immune from D.

If the aggressive new biotypes remain restricted to their present narrow zone of incidence, they should soon be eliminated by the legislation providing for the exclusive cultivation of immune varieties as from 1st March, 1941 [*R.A.M.*, xix, p. 320], but even should their distribution become wider, the prompt notification of each new focus of infection, as required by the operative regulations, should ensure the rapid identification and eradication of the particular biotype concerned.

T

Holmberg (C.). **Potatiskräfta och Potatisål i Sverige under 1942.** [Potato wart and Potato eelworm in Sweden during 1942.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh.*, vii, 1, pp. 14–16, 1 map, 1943.

During 1942, 146 new cases of potato wart [*Synchytrium endobioticum*] were registered throughout Sweden, compared with only 33 in 1941 [*R.A.M.*, xxii, p. 109]. The fresh foci of infection are situated mostly in the south, 116 being in Scania, where the Kristianstad district is particularly severely affected; in this area the number of cases (98) detected in the one year under review almost equals the total for the period from 1928 to 1941.

Murray (R. K. S.). **Botanical and Mycological Department.**—*Rep. Rubb. Res. Bd Ceylon, 1941*, pp. 7–15, 1942.

The decisive influence of atmospheric temperature on the incidence of *Oidium* leaf disease of rubber [*O. heveae*] was again demonstrated in 1941 [*R.A.M.*, xxi, p. 97], the pathogen being almost absent during February and the first half of March, when abnormally high temperatures prevailed in the low country both in the daytime and at night. With the onset of wet and cooler weather after the middle of March late-wintering trees contracted infection. Information from mid-country estates denoted that the attack was relatively mild below an elevation of some 1,500 ft., above which level the usual extensive defoliation was observed. Under these conditions it was necessary to maintain the standard schedule of sulphur-dusting treatments, which could safely be reduced or altogether dispensed with at lower altitudes. A 'museum' collection of clones from individual trees showing resistance to *O. heveae* was established on an estate at Matale, about 1,500 ft. above sea-level, the first planting of 37 clones having been completed during the north-east monsoon. In a small-scale test the addition of soda ash to sulphur in the ratio of 20 : 80 exerted no detrimental action on the flowers, both the mixture and sulphur alone increasing the set of seed by protecting the inflorescences from mildew. This treatment, therefore, would be unlikely to assist in the control of the pod and leaf rot caused by *Phytophthora palmivora* through a reduction in the amount of susceptible material available to the pathogen. The continuous wet weather also favoured the other forms of infection by *P. palmivora*, i.e., canker, bark rot, and die-back of the terminal shoots of young plants, while pink disease [*Corticium salmonicolor*] was likewise unusually prevalent in immature areas.

Martin (T. L.), Anderson (D. A.), & Goates (R.). **Influence of the chemical composition of organic matter on the development of mold flora in soil.**—*Soil Sci.*, liv, 4, pp. 297–302, 4 graphs, 1942.

The changes occurring in the chemical composition of organic materials, viz., sweet clover [*Melilotus alba*], lucerne, whitetop (*Lepidium draba*), Russian thistle (*Salsola pestifer*), wheat straw, and maize fodder during the process of decomposition in a dark grey, sandy loam Utah soil appear to induce corresponding alterations in the mould flora [*R.A.M.*, xxii, p. 110]. The higher the percentage of readily decomposable carbohydrates, e.g., sugars, starches, and some hemicelluloses and celluloses, the greater is the predominance of *Mucor rouxii* and *Rhizopus nigricans* in relation to other moulds present in the soil-organic matter mixture. With the decline in the incidence of these species, from the 60th day onwards, corresponding to the production in the soil of a stable hemicellulose and cellulose fraction, *Penicillium glaucum* and *Aspergillus niger* assume greater prominence, while about the 100th day, when lignin was the chief constituent remaining of the original plant material, *Cladosporium*, *Alternaria*, and *Aspergillus minutus* began to develop, their incidence reaching a peak from the 120th to 140th.

Brandenburg (E.). **Mangelkrankheiten als Gegenstand phytopathologischer Forschung.** [Deficiency diseases as the object of phytopathological research.]—*Z. PflKrankh.*, liii, 1–3, pp. 19–24, 1943.

Some of the outstanding advances made during the past 15 years in the recognition and control of deficiency diseases of plants are reviewed. The discovery of the so-called ' trace ' elements, manganese, boron, and copper in the soil opened up an entirely new phase in the study of disorders caused by their absence or shortage, e.g., heart and dry rot of beets, reclamation disease of oats and other crops, and marsh spot of peas, associated, respectively, with boron, copper, and manganese deficiency. References to all the investigations mentioned have appeared from time to time in this *Review*. The field of research on disturbances of the type under discussion is thought to be by no means exhausted, the etiology of various fruit and vine chloroses in relation to iron, for instance, urgently requiring further elucidation. Deficiency diseases constitute, as it were, a border-line problem in the solution of which experts in matters relating to phytopathology, the physiology of nutrition, soil biology, and the use of synthetic fertilizers may fruitfully co-operate.

Kovačevski (I. C.). **Die Buntblättrigkeit der Paprikapflanze (Capsicum annuum) (Medicago virus 2 K. Smith var. typicum Black u. Price). Vorläufige Mitteilung.** [Mosaic of the Chilli plant (*Capsicum annuum*) (*Medicago* virus 2 K. Smith var. *typicum* Black & Price). Preliminary note.]—*Z. PflKrankh.*, lii, 12, pp. 533–540, 7 figs., 1942.

Chilli mosaic [*R.A.M.*, xix, p. 254; xxi, pp. 324, 408] is stated to be very widespread in Bulgaria, up to 30 or 40 per cent. of the plants in almost every stand inspected during the late summer being affected. The most prominent feature of the disorder are the conspicuous, sharply defined, white or yellow lesions, more aptly termed zones, which are mostly uniformly distributed over the leaf blade, with a frequent tendency to elongation in proximity to the veins. Generally speaking, the size of the lesions and the intensity of their coloration decrease from the base upwards, the shade ranging from greenish-white to lemon-yellow on the lower and middle leaves, on which the spots resemble those of the aucuba or calico viruses of potato, whereas on the apical foliage the small, inconspicuous mottling might easily be confused with that caused by the viruses of cucumber or tobacco mosaic or potato virus Y. Malformation and curling may occasionally be observed on leaves attacked at an early stage of development.

Quite another type of symptom is encountered in some cases, especially in inoculation experiments. A more or less vivid yellow zone radiates from the leaf tip or the upper leaf margins towards the midrib, gradually diffusing into the interveinal spaces, which turn completely yellow, sometimes with the exception of a narrow, green zone. The discoloration may also originate at the base of the leaf and extend upwards. Much rarer is the development of a pattern consisting of densely clustered rings or parallel zig-zag lines, imparting to the leaf a striking tortoiseshell effect, somewhat resembling that induced on the chilli plant by cucumber mosaic. Necrosis has so far only been encountered in inoculated plants in the form of brownish, circular, arcuate, or zig-zag lesions on the leaves and short, necrotic stripes on the stem and petioles. The distortion of the fruits occasionally noted on plants affected by mosaic is very similar to that caused by cucumber mosaic, and setting may be considerably reduced, but in spite of the intensive disorganization of the chlorophyll accompanying this disease, it is much less detrimental to the chilli than the cucumber or tobacco mosaic viruses.

Chilli plants in the greenhouse were inoculated with juice from variegated chilli, potato suffering from calico, and lucerne affected by mosaic [ibid., xix, p. 563], the percentage of positive infections ranging from 0 to 90 but generally averaging under 30, while rubbing was uniformly essential and the incubation period fairly lengthy—

10 to 15 days or upwards. Only in one out of three series of aphid transmission tests were three out of six plants successfully infected by means of *Myzus persicae*. Potted lucerne plants, rubbed with juice of a mosaic chilli, contracted infection almost as rapidly as the original host, but at the high temperatures of the greenhouse the resultant symptoms soon became masked. Although Samsun and White Burley tobacco, *Nicotiana glutinosa*, and *Datura stramonium* were included in nearly all the trials, mosaic developed only in two Samsun plants and one *D. stramonium*. Potatoes responded negatively to all attempts at infection. The virus is less aggressive in its attacks on chilli than any other affecting this host in Bulgaria, excepting potato virus Y, but its prevalence is explained by the large number of hosts serving as sources of inoculum.

The results of these experiments are considered to point to *Medicago* virus 2 K. Smith var. *typicum* Black & Price [lucerne mosaic: ibid., xix, p. 563] as the cause of chilli mosaic in Bulgaria, where potato calico (var. *solani*), the other possible agent, has only once been encountered on Odenwälder Blaue plants raised from imported seed.

Rangaswami [Iyengar] (R. S. S.) & Griffith (A. L.). **Demonstration of Jassus indicus (Walk) as a vector of the spike disease of Sandal (Santalum album, Linn.).**—*Indian For.*, lxvii, 8, pp. 387–394, 4 pl., 1941.

In a further experiment on the transmission of sandal spike [*R.A.M.*, xx, p. 133] at Javalgiri, North Salem (Madras), four out of eight healthy two-year-old sandal plants (one parasitic on *Acacia farnesiana* and the other three on *Mundulea suberosa*), placed in a cage into which 29 individuals of *Jassus indicus* were released between 30th June and 16th August, 1940, manifested the typical symptoms of the disease between October and December, the minimum and maximum incubation periods being 102 and 122 days, respectively. In the same cage was a disease-masking sandal plant on *Solanum seaforthianum* which provided the infective material. A healthy plant grafted with disease-masking material from one of the experimentally infected ones on 26th January and 23rd February, 1941, showed spike symptoms on 28th April, i.e., 91 days from the first and 64 from the second set of grafts, the previous minimum and average periods for the appearance of symptoms in grafted plants having been determined as 31 and 138 days, respectively. On the same date one of the caged plants was already dead and the other three obviously in a declining condition. In a further test in November and December, 1940, suspicious symptoms developed in the following June on four out of seven plants caged with *J. indicus*.

Bell (A. F.). **Report of the Division of Entomology and Pathology.**—*Rep. Bur. Sug. Exp. Stas Qd, 1941–42*, pp. 12–13, 1942.

In this report on sugar-cane disease work in Queensland during the period under review [*R.A.M.*, xxi, p. 303], the author states that gumming disease (*Bacterium* [*Xanthomonas*] *vasculorum*) is rapidly vanishing from the known areas of infection in the Mulgrave and Hambledon districts. After the remaining fields of S.J.4 have been ploughed out at the close of the present season, incidence should be very light.

The absence of the normal wet monsoon season in 1942 reduced the natural transmission of downy mildew [*Sclerospora sacchari*], and provided an opportunity to clean up a number of infection centres. Scattered stools of non-approved susceptible varieties are still found on certain farms, and it will not be safe to reintroduce P.O.J. 2878 until these have all been removed.

A conspicuous improvement as regards Fiji disease was again seen in the Maryborough area, where, in selected localities, the reintroduction of susceptible varieties has already begun. Inspection of 7,178 acres in the Isis district during the year ending 31st March, 1942, revealed the presence of only 63 affected stools

on 10 farms. In the Bundaberg district, 35,179 acres were inspected, and 4,777 diseased stools were found, which represents a loss of about 0·0025 per cent. of the district crop. Control of Fiji disease is much more difficult in the Moreton district, owing to the absence of autumn planting, the greater proportion of stand-over cane, and better growing conditions. Loss of crop is, however, so far negligible. In the Fiji disease resistance trial now approaching completion it has become apparent that the Hawaiian canes 28–4291, 31–2484, 31–2806, and 32–8560 all possess high susceptibility, while Q. 28 appears to be very resistant. No sign of infection has been noted on either *Saccharum robustum* Tank or *S. robustum* Burma.

Owing, probably, to increased planting of the Oramboo variety, leaf scald (*Bact.* [*X.*] *albilineans* was more prevalent than before in North Queensland. It is important only in wet areas, diseased stools tending to die out in areas where the soil is dry during spring.

Because of the failure of the usual monsoonal late-summer rains, red stripe [*X. rubrilineans*] and top rot were not at all prevalent, but the dry spring of 1941 induced some stem rot in over-mature canes. In a field at Meringa, where patches of severe top rot were present, the moisture equivalent was found to be low in these patches. Heavy dressings of filter press mud were made on these places, with the result that top rot gradually declined.

In field germination studies preliminary tests with various substances under ordinary and relatively aseptic conditions indicated that while none exercised any direct stimulation, some greatly delayed internal rotting of the seed piece. The best mercurials effectively increased rate and percentage of germination under conditions of low temperature and soil moisture, in which germination is normally retarded. Strong protective action [against rotting] was observed when treated and untreated setts were planted in soil previously inoculated with the spores of *Thielaviopsis* [*Ceratostomella*] *paradoxa*.

Forbes (I. L.) & Dufrénoy (J.). **Internal breakdown of Sugar Cane associated with mosaic.**—Abs. in *Phytopathology*, xxxiii, 1, pp. 3–4, 1943.

In 1941, 22 mosaic-diseased stalks of the C[anal] P[oint] 33/243 sugar-cane variety were observed to be affected by a breakdown and collapse of the central pith cells in well-marked, elongated areas in some, but usually not all, of the internodes between the base and top of the stalk. In the same season over 200 stalks of mosaic-free cane were free from internal breakdown. In 1942 all 64 mosaic stalks suffered from breakdown, while two out of 39 apparently healthy ones each showed a very small lesion, the development of which coincided with foliar mosaic, indicating a connexion between the two symptoms. Sections through the lesions revealed the diffusion of the vacuolar contents (mostly phenol compounds) into the intercellular spaces, which, together with the cell walls, stain deep red with chlorhydric phloroglucin, while the residual material left in the cells flocculates into a brown sediment and settles at the bottom. Internal breakdown is stated to have occurred in other varieties in the past.

Fitzpatrick (H. M.). **Revisionary studies in the Coryneliaceae. II. The genus Caliciopsis.**—*Mycologia*, xxxiv, 5, pp. 489–514, 35 figs., 1942.

The author supplies a diagnosis of the genus *Caliciopsis* with notes, descriptions, and a key to its ten species, of which two are new to science.

Miller (J. H.) & Burton (M. Gwendolyn). **Studies in some Venezuelan Ascomycetes collected by C. E. Chardon and A. S. Müller.**—*Mycologia*, xxxv, 1, pp. 83–94, 10 figs., 1943.

Dothiora subtropica, parasitic on stromata of *Bagnisiopsis* on Melastomaceae in the tropics, and other species are discussed in relation to problems of the phylogeny

of the Ascomycetes. *Mycosphaerella venezuelensis* n. sp. is described on leaves of *Canavalia ensiformis* from Venezuela.

Bose (S. R.). **Moisture-relation as a determinant factor in the transformation of the basidia of certain Polyporaceae.** *Mycologia*, xxxv, 1, pp. 33–46, 8 figs., 1943.

The phenomenon, previously observed by the author in *Ganoderma lucidum* and a number of other Polyporaceae [*R.A.M.*, xiv, p. 611], of the transformation of basidia into hyphal elongations with terminal spores exactly like basidiospores at the end of the rainy season or during intervals between rains, and, later, their reversion into basidia on the advent of rain, has been reproduced experimentally during 1938 and 1939. Consistent results were obtained with thin and easily desiccated specimens of species of *Polyporus*, *Polystictus*, and *Trametes*: when dry pieces of the fruit bodies were placed in running water from a laboratory tap overnight the hyphal elongations entirely disappeared from the pore tubes, giving place to mature basidia with sterigmata and spores, whereas in pieces of the same fruit body stuck to the lid of a moist agar plate and sectioned daily it was found that as the condensation water gradually disappeared in the course of three or four days and the relative humidity of the plate became reduced to about 85 per cent. a large number of clamped and elongated hyphae with terminal spores and a few abnormal elongated narrower basidia developed in the pore tubes. When the test pieces were exchanged and the experiment repeated, the same result was obtained. The experiment did not succeed well with very thick or soft specimens of *Polyporus*, *Trametes*, *Lenzites*, *Daedalea*, *Fomes*, and other species, for all specimens do not withstand desiccation to the same degree.

It is concluded that the transformation of basidia into hyphal elongations with clamp-connexions and terminal spores and its reversal are mainly controlled by the water relation. In some specimens of *G. lucidum* collected in 1937 and 1938, brown thick-walled basidia, resembling those described in *Podaxis indicus* and *P. aegyptiacus* under the name of pseudobasidia, were found in the hymenial layer.

Knight (C. A.). **The sulfur distribution in the rib-grass strain of Tobacco mosaic virus.**—*J. biol. Chem.*, cxlvii, 3, pp. 663–666, 1943.

Analysis of the rib-grass [*Plantago lanceolata*] strain of tobacco mosaic indicated that its sulphur content amounts to 0·62 per cent., or about three times the proportion of this element found in the ordinary strain [*R.A.M.*, xxii, p. 44], whereas the cysteine content of the former, measured by three methods, is apparently the same as in the latter, i.e., 0·68 per cent. Quantitative analysis by two methods, however, revealed the presence in the rib-grass strain of 2 per cent. methionine, which was shown by qualitative tests to be absent from the seven other strains of tobacco mosaic examined. All or virtually all the sulphur present in the rib-grass virus is believed to be accounted for in its cysteine and methionine contents.

Smith (T. E.) & Clayton (E. E.). **Control of Granville wilt (Bacterium solanacearum) of Tobacco and other plants by applications of urea to the soil.**—Abs. in *Phytopathology*, xxxiii, 1, pp. 11–12, 1943.

Applications of urea in the form of uramon (42 per cent. nitrogen) were made in triplicate to the soil of three-row plots, 109 ft. long, naturally infested by *Bacterium solanacearum* [*R.A.M.*, xxii, p. 133] in which tobacco was growing, at dosages of 250, 500, and 1,000 lb. per acre, the material being broadcast over the surface and disked into the soil to a depth of 6 in. On 1st August, 1942, 80, 68, and 13 per cent., respectively, of the plants treated at these rates on the previous 17th October were

wilted, the corresponding figures for those given the same amounts of the disinfectant on 24th March, 1942, being 49, 34, and 3 per cent., respectively. In another test the application of uramon, ten weeks before planting, to plots of infested soil of tobacco, tomato, potato, eggplant, chilli, *Petunia*, black nightshade [*Solanum nigrum*], and castor bean [*Ricinus communis*], at 500 and 1,000 lb. per acre, effectively combated the pathogen and, in fact, almost eliminated it at the stronger dosage, whereas the untreated stands of the more susceptible species were wilted by 1st August.

Clayton (E. E.) & Stevenson (J. A.). **Peronospora tabacina Adam, the organism causing blue mold (downy mildew) disease of Tobacco.** *Phytopathology*, xxxiii, 2, pp. 101–113, 1 graph, 1943.

Among the problems confronting mycologists in connexion with tobacco downy mildew (*Peronospora tabacina*) are (1) the present position with regard to identification methods for the organism in question and other Peronosporaceae; (2) the source of infection in the United States; and (3) the reason for the temporary disappearance of the disease following the sudden outbreak of 1921.

Of 30 collections of diseased leaves of various species of *Nicotiana* grown under uniform greenhouse conditions from October, 1940, to April, 1941, 23 differed significantly in conidiophore length, and 25 in the length or breadth, or both, of the conidia, from the 'grand mean' derived from 40 collections of infected tobacco foliage. The range of means for the conidia was found to extend from 17 to 28 by 13 to 17 μ, these differences being too wide to allow of definite identification by measurements. Again, the marked variations in oospore size (mean of 27·8 to 39·9 for nine collections) preclude the use of this character as a taxonomic criterion, unless to place the organs within the limits for the genus (20 to 60 μ). No aid to specific determination is afforded by the morphology of the conidiophores, conidia, or oospores of *P. tabacina*, which are devoid of distinguishing characters, and the only definite basis of identification appears to be the pathogenicity of the fungus, which is virtually confined to the genus *Nicotiana*. There seems to be no convincing evidence of the existence of more than one species of *Peronospora* parasitic on *Nicotiana*, and the name accepted for this organism is *P. tabacina*.

The fungus is believed to be endemic in all the temperate-zone regions to which *Nicotiana* is indigenous, i.e., parts of North and South America and Australia.

Failure to form oospores in 1921 is thought to have been the cause of the non-recurrence of the pathogen in 1922 in the Georgia Florida tobacco-growing regions.

Hopkins (J. C. F.). **Mycological Notes. 16. The campaign against the kromnek virus.**—*Rhod. agric. J.*, xl, 1, pp. 47–49, 1943.

Investigations carried out in Southern Rhodesia in 1940 showed that the 'kromnek' virus [tomato spotted wilt: *R.A.M.*, xx, pp. 85, 282; xxi, p. 354] was widely distributed in Bulawayo, spread having resulted, apparently, from the sale of infected *Dahlia* tubers. Affected *Dahlia* plants were found in 18 of 20 gardens inspected in the suburbs. Because of the potential danger to tobacco areas, an appeal was made to the gardeners of Bulawayo to refrain from distributing *Dahlia* tubers, and, in addition, quarantine restrictions were placed on nurseries [ibid., xix, pp. 568, 576]. It was then suggested that the complete destruction of all the *Dahlia* plants in the town would be the ideal means of control, and the great majority of growers did, in fact, comply with this suggestion.

The following season a house-to-house inspection was made, together with a detailed inspection of nurseries. It was ascertained that the destruction of *Dahlia* plants on private properties had almost completely checked the disease before it became established on alternate hosts, but that in spite of the destruction of all

such plants in public gardens (where the disease had been present for two seasons), kromnek had spread to many other plants, including many perennials and weeds.

A study of the symptoms on different hosts indicated that all concentric ring, diamond, or fern-leaf patterns, particularly if associated with the leaf veins, were symptoms of kromnek. There was thus strong circumstantial evidence that the following were alternate hosts: *Impatiens balsamina*, *Celosia*, *Cassia floribunda*, *Agapanthus*, *Calendula officinalis*, screw pine (*Pandanus* sp.), *Cestrum*, *Coreopsis*, *Solanum seaforthianum*, and black jack (*Bidens pilosa*), all of which showed yellow or white rings, diamond and line patterns, etc.; *Browallia*, *Scabiosa*, *Zinnia*, and *Pentstemon*, which showed yellow blotches with or without rings and stem-twisting; *Campanula*, *Viola*, ivy-leaf geranium (*Pelargonium*), and *Dieffenbachia*, which showed pale green and yellow rings and mosaic mottling; aster (*Callistephus*) [*chinensis*], African marigold (*Tagetes erecta*), *Brunfelsia*, and *Primula obconica*, which showed stunting, distortion of the young leaves, and yellow mottling; and nasturtium [*Tropaeolum majus*], which showed a pale green, indefinite pattern following the veins, yellow and green mottling, and cupping of the foliage.

A strenuous policy of eradication and destruction was taken up, but the disease reappeared in November, 1941, in *Zinnia* seedlings raised in the nursery to test for the presence of the condition. A few *Brunfelsia* seedlings showing mottling and distortion of the foliage were growing a few yards away, and three small plants of *Pandanus utilis* were also present, and were suspected. All these were destroyed. At the same time kromnek reappeared in *Primula obconica* in the greenhouse, spread, apparently, having occurred from a young screw pine. The primulas and the screw pine were destroyed, and no case of infection has since been observed in the public gardens.

In Bulawayo itself the position remained good until January, [1942], when affected *Dahlia* plants were found in a nursery. Some tubers from these were sold and have not yet been traced. A number of plants from the affected tubers were, however, examined, with the result that the following varieties were ascertained to be affected: Eagle Rock Fantasy, Normandie, Jersey White Beauty, Fireman, Winoka, The Rosary, Flammander Sonne, Royal Flush, Rev. A. J. Norton, Lady Stonehaven, and (suspected) Aimee Hodgens. All tubers of these varieties from the infected nursery are assumed to be affected, and the Agricultural Department desires to trace their distribution.

Dippenaar (B. J.). **The control of virus diseases in Tomatoes.**—*Fmg S. Afr.*, xviii, 204, pp. 163–164, 168, 1943.

Brief, practical directions are given for the control of virus diseases of tomatoes in South Africa, particularly spotted wilt, mosaic, and a condition causing dying-back of the tips of shoots and brown streaks on the stems, which are stated to be those most prevalent in the Stellenbosch–Elsenburg area. The control measures listed, which have given fairly successful results in experimental tests, are as follows. Seed-beds should be made on fresh soil some distance away from flowers and vegetables and remote from potato and tobacco lands. The surrounding grass, weeds, or bushes should be dusted with fine sulphur. When about 1 in. high, the tomato plants should be given a thorough application of nicotine or sulphur dust, care being taken not to introduce too much sulphur into the soil. After this, nicotine and sulphur dustings must alternate at weekly intervals up to transplanting time. Just before transplanting, the seed-beds may be copiously dusted with sulphur. Sulphur dust should again be applied three weeks after transplanting, the treatment being repeated two or three weeks later. The plants should be examined about three weeks after transplanting, and every 10 days afterwards, all affected plants being removed and destroyed. Roguing can be discontinued when the plants have attained half their full height.

Händler (E.). **Über die Braunfleckenkrankheit der Tomate.** [On the leaf mould disease of the Tomato.]—*Kranke Pflanze*, xix, 9–10, pp. 91–93, 2 figs., 1942.

The essential information concerning tomato leaf mould (*Cladosporium fulvum*), which was, as usual, prevalent in glasshouses at Pillnitz (Elbe Valley) in 1942, is briefly summarized, and directions are given for its control by cultural measures, directed primarily against the formation of dew on the leaves, supplemented where necessary by fungicidal treatments, e.g., spraying with 0·75 to 1 per cent. solbar or 2per cent. lime-sulphur, or vaporization of the houses with the 'sulfurator' apparatus [*R.A.M.*, xv, p. 298 *et passim*] (A. Treppens & Co., Lindenstrasse 13, Berlin, SW. 68), using 500 gm. sulphur per 1,000 cu. m. Bulbosan, a new dust product of the J. G. Farbenindustrie, free from both copper and sulphur, is also reported to have given good control of *C. fulvum*. None of the tomato varieties grown commercially has given any marked indication of resistance to leaf mould, though Lucullus is reputed to withstand the disease somewhat better than Tuckswood.

Alben (A. O.) & Hammar (H. E.). **Progress report on soil applications of zinc sulphate in the control of rosette of Pecan.**—*Proc. Tex. Pecan Grs' Ass.*, xxi, pp. 63–70, 1941. [Abs. in *Biol. Abstr.*, xvii, 3, p. 873, 1943.]

Pecan rosette generally yielded in the course of two years to heavy applications (150 to 200 lb. per sq. ft. of a cross-sectional area of the trunk,) of zinc sulphate [*R.A.M.*, xix, p. 736] on slightly acid sandy and heavy alkaline soils in Texas. Previous experiments had shown that smaller amounts of the compound failed to give adequate control. The combination of sulphur and manure with the zinc sulphate on the heavier soil types and of manure alone on those of sandy texture may enhance the value of the chemical in the control of the trouble.

Hahn (G. G.). **Taxonomy, distribution, and pathology of Phomopsis occulta and P. juniperovora.**—*Mycologia*, xxxv, 1, pp. 112–129, 2 figs., 1943.

In comparable wound inoculation tests carried out during 1941 in an unheated greenhouse in the Marsh Botanical Garden, Yale University, New Haven, Connecticut, monospore cultures of *Phomopsis occulta* [*R.A.M.*, xx, p. 551], obtained from both wildling and nursery stock, failed to infect any of the 14 wildling eastern red cedar (*Juniperus virginiana*) saplings inoculated, whereas inoculations with *P. juniperovora* [loc. cit.] were entirely successful in all seven saplings used. Of these seven, those of a bluish-green colour were girdled and killed, whereas others, of a lighter and brighter green showed some resistance, the palest green tree among them developing only non-girdling cankers and no discoloration of lateral branches. Re-isolations of *P. juniperovora* on synthetic malt agar yielded the yellow colour and flaming orange crystals typical of the growth of this fungus on a number of media. These two characters, which do not appear in cultures of *P. occulta*, are considered the safest means of differentiating these two species, since their spore size ranges tend to overlap. *P. occulta* is stated to be widely distributed on conifers both in western Europe and throughout North America, while its perfect stage, *Diaporthe conorum*, though common in Europe, is very rare in the Western Hemisphere.

In the course of the author's investigations in Great Britain from 1926 to 1929, fruiting bodies of *D. conorum* were obtained experimentally on twigs of English elm (*Ulmus procera*) from monopycnidiospores of the fungus originally isolated from cultures of monoascospores of *D. conorum* from Douglas fir [*Pseudotsuga taxifolia*]. These data, published now for the first time, are thought to support Wehmeyer's opinion of the relationship of *Diaporthe* species on conifers to *D. eres*, although the homothallic *D. conorum* holds priority. *P. occulta* is considered to be a secondary invader of cedars following some injury to the host plant, although some

strains of it were found to be capable of weak parasitism on the coast form of Douglas fir. The pathogenic species, *P. juniperovora*, the *Diaporthe* stage of which is as yet unknown, is stated to be parasitic under natural conditions only on hosts belonging to the genera of the Cupressaceae, a revised list of which is given. Under experimental conditions saplings of the coast form of Douglas fir were found to be highly susceptible to this fungus, but nursery stocks of this host were never observed to be attacked. The fungus is stated to occur as a nursery parasite in Europe and in the United States. The first, and so far the only, record of *P. juniperovora* on wildling red cedars refers to a small number of fruiting bodies collected and identified in culture by the author and Dr. Wright in Nebraska.

Miller (J. K.). **Fomes annosus and Red Cedar.**—*J. For.*, xli, 1, pp. 37–40, 1943.

This is a report on the writer's six-year study in the Duke Forest, North Carolina, on the part played by *Fomes annosus* in the death and decay of the red cedar (*Juniperus virginiana*). The fungus was found to be capable of killing trees of all ages from the seedling stage to maturity, besides causing a pocket rot of the stem base and thereby reducing the value of butt logs sold to the manufacturer. Damage is particularly severe in plots in which the cedar is grown as an under-story tree, over-topped by other species and so deprived of its necessary quota of sunlight, and control should be based on the avoidance of these conditions in the choice of a site. In two instances fructifications of *F. annosus* were observed on two species growing in proximity to red cedars, from which they had spread by means of extensively branching, white mycelial strands, viz., *Liquidambar styraciflua* and *Rhus toxicodendron*, but penetration was not effected.

The fungus was shown in laboratory experiments to produce the following enzymes: asparaginase, catalase, cellulase, emulsin, erepsin, inulase, laccase, ligninase, pectinase, pepsin, peroxidase, sucrase, tanninase, trypsin, tyrosinase, and zymase.

Diller (J. D.). **A canker of eastern Pines associated with Atropellis tingens.**—*J. For.*, xli, 1, pp. 41–52, 3 figs., 1 diag., 1 graph, 1 map, 1943.

General field observations in the eastern United States, covering a period of seven years, together with the data from permanent sample plots in planted and natural stands of slash pine (*Pinus caribaea*), indicate that the canker caused by *Atropellis tingens* [*R.A.M.*, xxii, p. 187] has been responsible for only negligible damage. Even in the epidemic years of 1933 and 1934, when severely infected trees lost up to one-third of their crowns, no curtailment of height and diameter increment ensued. Besides slash pine, the following species of eastern pine are liable to infection by *A. tingens*: *P. banksiana*, *P. clausa*, *P. echinata*, *P. pungens*, *P. resinosa*, *P. rigida* and its var. *serotina*, *P. strobus*, *P. taeda*, and *P. virginiana*, while two native western (*P. contorta* and *P. ponderosa*) and four introduced species (*P. densiflora*, *P. nigra*, *P. pinaster*, and *P. sylvestris*) are also subject to attack. Twenty States have been found to harbour the fungus, namely, Alabama, Arkansas, Delaware, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Missouri, New Hampshire, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee, Texas, and Virginia.

Rennerfelt (E.). **Die Toxizität der phenolischen Inhaltsstoffe des Kiefernkernholzes gegenüber einigen Fäulnispilzen.** [The toxicity of the phenolic ingredients of Pine heartwood to some rot fungi.]—*Svensk bot. Tidskr.*, xxxvii, 1, pp. 83–93, 1 fig., 2 graphs, 1943.

The phenolic substances, pinosylvin and pinosylvin monomethylether, occurring in pine heartwood, were tested in malt agar cultures at 22° C. for their fungicidal properties and found (the former in particular) to exert a strongly toxic action on certain wood-destroying fungi. Thus, a concentration of 0·01 per cent. pinosylvin

sufficed to arrest the growth of *Polyporus betulinus* and *Polystictus hirsutus*, while *Schizophyllum commune* was somewhat more resistant, developing to a slight extent in the presence of 0·02 per cent. of the phenol, and *Fomes annosus* only succumbed to a dosage of 0·1 per cent. Pinosylvin itself was about 20 times as toxic to *F. annosus*, *P. hirsutus*, and *S. commune* as its monomethylether, whereas *Polyporus betulinus* was equally sensitive to both substances. The phenol coefficient of pinosylvin is five to ten times that of the monomethylether. Pine heartwood blocks impregnated with the latter were much less severely attacked by *Lentinus squamosus* than the untreated controls, but in the case of *F. annosus* little difference was observed between the two series.

Ludbrook (W. V.). **Fertilizer trials in southern New South Wales Pine plantations.**—*J. Coun. sci. industr. Res. Aust.*, xv, 4, pp. 307–314, 1942.

Large-scale experiments carried out in New South Wales on the control of pine-tree needle fusion [*R.A.M.*, xxii, p. 231] by dressings of superphosphate, rock phosphate, and boron compounds showed that affected *Pinus caribaea* and *P. taeda* trees failed to respond to phosphatic fertilizers during the first season after treatment, but during the next three seasons the treated trees showed a much higher percentage of recovery than the untreated. Boron compounds reduced the symptoms much more rapidly than superphosphate, but the effect generally lasted for only one season. During the second and third seasons after broadcasting phosphatic fertilizers under the trees, marked responses in volume increment and in recovery from needle fusion were shown by *P. caribaea* and *P. taeda* in one locality, though in another, treatment of *P. taeda* with 2½ cwt. superphosphate per acre was ineffective, possibly owing to drought. In the Moss Vale area 1½ or 3 cwt. superphosphate per acre had little or no effect on *P. radiata* trees 7, 9, and 17 years old, during three seasons after application. The same treatments, however, produced 35 per cent. increase in height growth, as compared with the untreated controls, in one-year-old self-sown seedlings on a burnt area at Penrose, during the season after application. This was maintained in the next season in the case of plots given the heavier application.

Benatar (R.). **Algumas observações sobre a hernia das cruciferas.** [Some observations on the 'club root' of crucifers.]—*Bol. Esc. nac. Agron., Rio de J., 1941*, 2, pp. 281–301, 8 figs., 1942. [English summary.]

The writer's studies on club root in crucifers, *Plasmodiophora brassicae* [*R.A.M.*, xxii, p. 40], were based on fixed and stained material of *Brassica acephala*. Accounts are given of the mode of propagation of the plasmodia through the host cells, the formation of tumours in the hadrocentric vascular bundles, and the morphological modifications induced in the structure of the host cell by contact with the encircling plasmodia.

Green (D. E.) & Ashworth (D[orothy]). **Club root of Brassicas—a test on its control.**—*J. R. hort. Soc.*, lxviii, 4, pp. 111–115, 1943.

The best control of club root (*Plasmodiophora brassicae*) on crucifers of various kinds in a test at Wisley, Surrey, in 1942 was obtained by raking into the soil just before sowing 4 per cent. calomel [mercurous chloride] dust at the rate of 1½ oz. per sq. yd., which reduced the incidence of infection in Ellam's Early, Harbinger, and Offenham cabbages, swedes, turnips, and kohlrabi from 74, 40, 80, 65, 12, and 78 per cent. in the untreated control plots to 3, 3, 0, 36, 0, and 16 per cent., respectively, at the counts made from 9 to 18 weeks after sowing [cf. *R.A.M.*, xi, p. 146; xxi, p. 177]. The corresponding figures for proprietary substances A and B (the former containing calomel dust), applied in the same way and at the same strength as the foregoing, were 18, 11, 7, 50, 4, and 23, and 8, 6, 27, 44, 0, and 4 per

cent., respectively. The results secured with hydrated lime (1 lb. per sq. yd.) and mercuric chloride (1 in 2,000, watered in drills across the plot, 1 pint per 5 ft.) were in general less satisfactory, though both completely eliminated the disease from the turnip stands, and the action of lime, moreover, is known to be slow. Early Market radishes were included among the trial plots but remained entirely free from club root [cf. ibid., xvi, p. 223], suggesting the possibility of physiological specialization within the fungus.

Gram (E.) & Bovien (P.). **Rodfrugternes Sygdomme og Skadedyr.** [The diseases and pests of root crops.]—125 pp., 48 pl., Copenhagen, Danish Agricultural Society, 1942. [Abs. in *Z. PflKrankh.*, liii, 1–3, pp. 141–142, 1943.]

Recent advances in the technique of colour reproduction have enabled the writers to depict with great accuracy the damage inflicted on fodder and sugar beets, kohlrabi, and carrots by adverse physiological factors, including the deficiency of essential elements and over-fertilizing, as well as by fungal and virus diseases and insect pests. Specially important diseases are illustrated in various stages of development.

Newton (Margaret) & Peturson (B.). **Uromyces betae in Canada.**—Abs. in *Phytopathology*, xxxiii, 1, p. 10, 1943.

Beet rust (*Uromyces betae*) was first detected in Canada in 1935 on sugar beet plots in two localities in British Columbia [*R.A.M.*, xv, p. 481], viz., Saanichton, Vancouver Island, and Agassiz on the mainland, the distance between which is 95 miles (including 35 of water and a high mountain range). In both places the plots were sown with seed imported from Europe and bearing large numbers of uredo- and teleutospores. The disease has been present every year since its first appearance in the Saanichton district, where its severity reaches a maximum in the early spring and late autumn. Greenhouse experiments showed the rust to be very sensitive to high temperatures, the optimum for uredospore germination being from 10° to 22° and for rust development from 15° to 22° C., beyond which ordinarily susceptible varieties acquire a resistant reaction culminating at 26°. The summer temperatures in Alberta, Saskatchewan, and Manitoba are probably too high for the development of the disease.

Kotila (J. E.). **A new Sugar Beet leaf blight caused by a strain of Corticium solani.**—Abs. in *Phytopathology*, xxxiii, 1, pp. 6–7, 1943.

Since 1938 a new form of foliar blight has been observed in commercial sugar beet-growing fields in Virginia and later in Michigan, Illinois, Wisconsin, and Minnesota, protracted spells of high humidity favouring the development and severity of the pathogen. The heart leaves are reduced to tip-burned stubs, while necrosis may involve one-third to one-half of the blade of older ones. The characters of the basidia, sterigmata, and basidiospores (8·0 by 12·9 to 4·8 by 8·0 μ) of the fungus produced on the dorsal leaf surface adjoining the infected tissue agree with those of *Corticium solani*, of which the strain under observation, however, is regarded as distinct from those previously reported as pathogenic to the same host [*R.A.M.*, xix, p. 59 *et passim*]. The inoculation of sugar beets with pure cultures of the fungus resulted in typical foliar symptoms and damping-off of seedlings, but no decay of half-grown roots. Basidiospore infection occurred in 60 per cent. of the beets exposed by placing them below leaves bearing the *Corticium* stage suspended on screens, whereas only one out of 58 controls in an adjacent compartment under comparable atmospheric conditions (90 to 100 per cent. relative humidity and a temperature of 75° to 80° F.) developed the symptoms, probably due to the accidental air dissemination of a basidiospore. Early field infections are believed to arise

from the soil-borne *Rhizoctonia* stage of the organism, and later ones from the basidiospores of *C. solani*.

Reinking (O. A.). **Distribution and relative importance of various fungi associated with Pea root-rot in commercial Pea-growing areas in New York.** *Tech. Bull. N.Y. St. agric. Exp. Sta.* 264, 43 pp., 12 figs., 1942.

In New York State the organisms primarily responsible for root rot of peas are, in descending order of importance, *Fusarium solani* var. *martii* f. 2, *Aphanomyces euteiches*, *Pythium ultimum*, *Rhizoctonia* [*Corticium*] *solani*, and *Ascochyta pinodella*. These (and the disease they cause) occur in soils with P_H values ranging from 6·25 to 7·48; in a few cases they occur at P_H 5·4 and 5·5.

F. solani var. *martii* f. 2, *P. ultimum*, and *C. solani* were ascertained to be indigenous to certain virgin pea soils. The first two multiply in the soil with repeated pea plantings, and the severity of pea root rot would appear to depend on the progressive accumulation of destructive fungi.

The evidence indicated that *F. solani* var. *martii* f. 2 is always active, accounting year after year for most disease, while *Aphanomyces euteiches* may be comparatively unimportant in very dry weather.

Six years' field studies on the Station farm, where peas have been grown in rotation for 16 years, demonstrated that the chief root-rot fungi were not completely eliminated by a 3-, 4-, or 5-year rotation, but commercially profitable yields were secured in favourable growing seasons on properly fertilized fields in spite of the presence of the organisms.

Proof was obtained that strains of *F. solani* var. *martii* f. 2 and of *P. ultimum* exist that vary in their ability to cause pea seed decay in moist soils and root rot with fatal stunting.

One strain of the former from root rot of a California red kidney bean was highly pathogenic to peas and able to attack dry beans, which should be excluded from a rotation in fields where peas are planted.

The following recommendations are made. Peas should be planted as early as possible, cool soil being unfavourable to fungal growth. Crop rotation and the maintenance of a high fertility level are of the first importance. In New York State peas should be planted only in selected, well-prepared and -fertilized, well-drained soils not previously planted to this crop for many years.

Snyder (W. C.). **Controlling Ascochyta blight of Pea.**—*Canning Age*, xxiii, 13, pp. 681–682, 684, 1 fig., 1942; xxiv, 2, pp. 96–97; 3, pp. 204–205, 1943.

This is a summary of the available information concerning pea blight (*Ascochyta pisi*, *A. pinodella*, and *Mycosphaerella pinodes*), which caused exceptionally heavy losses in 1941 and 1942 in the major pea-growing areas of the United States. The points discussed include the symptomatology of the disease, its development in relation to environmental conditions, the life-histories of the causal organisms, modes of perpetuation (mainly by the seed), and control (chiefly by cultural practices and frequent field inspections, since seed treatment, though useful as a precaution against surface contamination, is unavailing against internal infection). The blight pathogens have undoubtedly long been present in the western pea-seed producing areas of Idaho, Montana, Wyoming, Utah, Washington, and California, the writer having detected them in the heart of this region in 1930 and again found them present in 1941 in all the above-mentioned States except Wyoming and Utah, which were not visited.

Thomas (H. R.). **Cercospora blight of Carrot.**—*Phytopathology*, xxxiii, 2, pp. 114–125, 2 figs., 1943.

The writer's studies on carrot blight at Santa Maria, California, were concerned

primarily with the physiology of the causal organism, *Cercospora carotae*, and with the host-pathogen relationship and epidemiology of the disease. Under natural conditions the fungus attacks both wild and cultivated carrots, 107 varieties and selections of the latter showing no appreciable degree of resistance to the blight in field tests, while *Daucus hispanicus*, *D. maritimus*, *D. pulcherrimus*, *D. maximus*, *D. gingidium*, and *D. pusillus* also contracted infection. The elongated primary lesions, sometimes surrounded by a diffuse chlorotic border, are usually situated along the edges of the leaflets, causing a lateral curling and expanding until their ultimate coalescence involves and destroys the whole leaflet. Under humid conditions the lower surface of the diseased area is apt to present a pale grey or silvery appearance due to the profusion of hyaline to faintly tinted, cylindrical, 1- to 6-septate conidia, 40 to 110 by 2 to 2·5 (average $95 \pm 13{\cdot}5$ by $2{\cdot}2 \pm 0{\cdot}1$) μ, borne on fasciculate conidiophores, 2 to 3 μ in diameter, which develop on the infected surfaces before the host tissue is killed. The entire petiole of older leaves may be covered by linear, blackish-grey lesions, also assuming a pale grey to silvery cast on the formation of conidia, and sometimes girdling and killing the leaf.

The germ-tubes enter the plant through the stomata, the advancing hyphae being at first intercellular but soon invading the intracellular regions. Sporulation may begin soon after the establishment of the fungus in the substomatal cavity, but is more often delayed until deeper penetration is effected. The pathogen occupies all the epidermal and parenchymatous tissue between the two surfaces of the lamina, the mesophyll frequently being completely permeated within five days.

C. carotae made the best growth on potato dextrose agar, but satisfactory development also occurred on pea, carrot root, and prune agars. Maximum rapidity was secured between 19° and 28° C., the heaviest production of conidia from 16° to 28°, and a hydrogen-ion concentration of P_H 5·5 to 7 favoured vigorous growth. The organism was shown by field experiments to persist in the soil from one crop to the next and to be disseminated by wind to a distance of up to 300 ft. Viable conidia were found on the seed from diseased seed umbels. The treatment of artificially contaminated seed with ethyl mercury phosphate (5 per cent. dust or 1 in 24,000 solution), ethyl mercury tartrate (1 per cent. dust or 1 in 24,000 solution), mercuric chloride (five minutes at 1 in 1,000), or spergon dust resulted in freedom from fungal growth on potato dextrose agar, but an adverse effect on germination was exerted by the first-named preparation in its dry form.

Significantly fewer leaf spots per sq. cm. (0·19) developed on plants deprived of calcium or nitrogen than on those receiving a full complement of nitrogen, phosphorus, and potassium (0·31) or on those deficient in potassium (0·26) or phosphorus (0·28). The spots attained their maximum length of 6·5 mm. on the complete-nutrient plants, were intermediate on those lacking potassium or phosphorus, and shortest on the calcium- and nitrogen-deficient series (2·7 and 2·3 mm., respectively). Conidia were most numerous on the lesions on the complete-nutrient plants and fewest on those lacking phosphorus, calcium, or nitrogen, the position in respect of potassium shortage being intermediate. In cultures of *C. carotae* on sterile leaf-juice extracts from the various series heavier growth was obtained on those from the complete, potassium-, and nitrogen-deficient plants than in those deprived of calcium or phosphorus.

Pierce (E. C.) & Stoddard (D. L.). **Some effects of sand and nutrient supply on a physiological leaf spot of Cantaloupe.**—*Phytopathology*, xxxiii, 2, pp. 162–164, 1943.

A severe leaf-spotting of cantaloupes grown in quartz sand with a constant supply of nutrient at the Maryland Agricultural Experiment Station was shown by tests on the White Seeded Pink Meat variety to be due to the use of too fine a grade of

sand. The trouble was corrected by the substitution for the fine material of a coarser grade, the ratio of air space in the latter as compared with the former being as 8 : 1. An application of 500 ml. nutrient once every 24 hours was superior to other methods of supplying nutrient.

GARINO-CANINA (E.). **The utilization of Grape leaves treated with copper preparations.**—*Ann. Chim. appl.*, xxx, pp. 231–232, 1940. [Italian. Abs. in *Chem. Abstr.*, xxxvii, 6, p. 1556, 1943.]

The ash of vine leaves treated [against downy mildew, *Plasmopara viticola*] with copper preparations was found to contain 2 to 3 per cent. of the mineral, corresponding approximately to 25 kg. copper sulphate per ha. This copper is recoverable by treatment of the ash with ammonium hydroxide or solutions containing citric or tartaric acid. As an alternative, sulphur and a small quantity of an ammonium salt or citric acid may be added to the ash and the resultant mixture applied to the vines.

STELLWAAG (F.). **Stand und Krisis der Schädlingsbekämpfung im Weinbau.** [The status and crisis of pest control in viticulture.]—*Z. PflKrankh.*, liii, 1–3, pp. 113–124, 1943.

Most of the items of phytopathological interest in the author's survey of the present critical position of pest and disease control in German vineyards have been noticed in this *Review* from other sources, but it may be of interest to mention that W. Maier's investigations on the etiology of chlorosis [*R.A.M.*, xxii, p. 144] showed the trouble to have extended over some 5,000 ha. during the past few years. In connexion with the control of *Plasmopara viticola* the writer ascertained in 1932 that the disbursements for wages and fungicides in the Palatinate ranged from RM. 318 to 500 per ha., these figures agreeing in substance with those recently cited by [H.] Zillig in an exposition of the economic importance of vine protection in Germany (1941). The latter authority computed that the annual (Greater) German consumption of sulphur, copper sulphate, and spraying lime amount to 1,875, 20,000 and 10,000 tons, respectively. The cultural factors contributing to the difficulties of combating vine diseases and pests are discussed.

HADORN (C.). **Vergleichende Versuche im Jahre 1942 über Kupfersparmöglichkeiten im Weinbau.** [Comparative experiments in the year 1942 on the possibilities of copper economy in viticulture.]—*Schweiz. Z. Obst- u. Weinb.*, lii, 1, pp. 1–21, 1 diag., 5 graphs, 1943.

Thanks to the salvage of metal in Switzerland it was possible to set aside 400 tons of copper units for viticulture in 1942 [*R.A.M.*, xxi, p. 497], 40 per cent. of which, however, had to be utilized in the form of copper-Sandoz (red copper oxide with 50 per cent. metallic copper, the content of the latter in a 0·5 per cent. mixture being equivalent to that of 1 per cent. Bordeaux). This preparation should not be applied interchangeably with Bordeaux in the campaign against downy mildew (*Peronospora*) [*Plasmopara viticola*] but throughout the spraying period either by itself (0·5 per cent.) or with pomarsol (0·2 : 0·5 per cent.). Good to very good results were also obtained with pomarsol + Bordeaux mixture (0·5 : 0·2 per cent.) and 1·5 per cent. Bordeaux mixture, while 0·25 per cent. copper-Sandoz gave adequate control and some reduction of the incidence of infection was secured by treatment with 1 per cent. ramitol (an Italian product containing 8·2 per cent. metallic copper with a base of copper citrate + bentonite) and 1 per cent. cupramina, also of Italian manufacture, consisting of copper and ammonia neutralized by hydrated lime, with a metallic copper content of 8·1 per cent.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 2, pp. 98–104, 6 figs., 1943.

Potato leak or watery wound rot (*Pythium de Baryanum*) is not widely prevalent in Victoria, where it is mostly confined to soils rich in organic matter, but it causes serious loss in transit and storage, particularly when the potatoes have been dug in warm weather. Infection always occurs through mechanical injury or following sun scald. The chief means of control is a four- to six-year rotation, which can include pasture, oats, onions, maize, and peas. Infected potatoes should be collected and destroyed. In areas where the disease is prevalent digging should be carried out in cool weather or, at least, in the cool part of the day. If digging is carried out in warm weather infection is reduced if 'short runs' are lifted and 'picked up', so that the potatoes are not left on the hot soil for long periods. After 'picking up' the bags should be removed promptly to a cool place. Special care should be taken to avoid injury when bagging, and only sound tubers should be bagged. Loading hooks should not be used on the bags.

Tomato early blight (*Alternaria solani*) is favoured by moist conditions and moderately high temperatures. The fungus effects entry to the fruit through insect punctures, wounds, and growth cracks. Storage losses are sometimes very heavy, especially in early tomatoes, which are generally kept in ripening rooms on arrival from Western or South Australia. In the warm, humid conditions prevailing in the ripening rooms the almost inconspicuous lesions rapidly enlarge, and mould develops. Tomato seedlings should be treated with a 7 per cent. copper dust, and the same treatment can be applied in the field if necessary.

Raspberry mosaic was found in the Kalorama and Silvan districts of Victoria. Growers should carry out an inspection for the disease early in December. It would be inadvisable to do this earlier, as an obscure condition, apparently of physiological origin, has been observed in the Kalorama district, the early symptoms of which resemble mosaic. A mottle, much fainter than that due to mosaic, develops, but there is no leaf distortion. The mottling spreads, and the second phase of this disease is the appearance of a cadmium yellow colour between the veins; later the affected tissue dies. Mosaic plants should be promptly removed and burnt. Cultivation of the very susceptible Everbearing variety should cease. At present the virus appears to be confined to this variety, and fair yields are still obtained from it, but if an insect vector were accidentally introduced into Victoria, all the other varieties grown might become affected.

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 3, pp. 149–154, 6 figs., 1943.

All varieties of French beans [*Phaseolus vulgaris*] grown in Victoria are susceptible to mosaic. Severe dwarfing and failure to produce seed are a very noticeable symptom in the Small White variety of Navy bean which has been widely sown in Victoria during the present season. Growers wishing to obtain clean seed should delay the sowing of seed crops until the arrival of warm weather, and should rogue their crops periodically throughout the growing season, beginning with the appearance of the first compound leaves, and repeating the operation every fortnight. The early roguings must be extremely thorough. A relatively small area isolated from other bean crops should be used. The evidence indicates that the disease is spreading.

Tomato bacterial canker [*Corynebacterium michiganense*: *R.A.M.*, xviii, p. 279; xxi, p. 353] can be controlled by selecting seed only from clean fields. As a further precaution, the seed should be extracted from the fruit by fermentation with the pulp without water for at least two days, and seed of unknown origin should be treated for 5 minutes with mercuric chloride ($\frac{1}{4}$ oz. in 5 gals. water). Finally the

seed should be washed in running water for 10 to 15 minutes. A field that has produced an infected crop should not be planted to tomatoes the following season.

Black spot or anthracnose (*Elsinoe ampelina*) is, locally, one of the commonest vine diseases. During pruning, badly diseased canes should be removed and burnt. During the dormant period the canes should be swabbed with a solution made up of 20 lb. sulphate of iron, 8 lb. commercial sulphuric acid, and 10 gals. water. At bud burst the canes should be sprayed with Bordeaux mixture (10–5–50), a 6–4–40 solution being used just before blooming and after fruit-setting. If the season favours infection, further applications should be made when the disease reappears.

Divisions of Plant Pathology and Seed Investigations.—*Rep. N.Y. St. agric. Exp. Sta., 1941–2,* pp. 52–60, 75–79, 1943.

In further work on apple scab [*Venturia inaequalis*] control in western New York [*R.A.M.*, xxi, p. 244] a wettable sulphur programme has replaced the lime-sulphur, which seriously reduced productiveness. Insoluble coppers were introduced to eliminate the risk of sulphur injury at high temperatures, and were also used with summer oil and nicotine. Improved methods were devised for testing commercial brands of these two groups of fungicides alone and in combination with insecticides.

It was found that on the whole wettable sulphurs with an average particle size of about 3 μ are most desirable. Lime (1–100) conspicuously increases the tenacity of most sulphurs of this group, and should be used when they are applied under unfavourable drying conditions. Orthex, useful for spraying in rain, impairs the fungicidal efficiency of sulphur when applied in cold water. Lime (1–100) tends to make the sulphur and oil sticker combination a valuable one, especially if a low concentration of sulphur is desired. Of the raw materials undergoing test, fermate [ibid., xxii, p. 213] shows the greatest possibilities, and will be particularly useful in the event of a copper shortage.

Under the conditions prevailing in the Hudson Valley no form of wettable sulphur, paste or dry, can be expected to give adequate protection against scab when used at less than 4 lb. of actual sulphur per 100 gals. of spray, and most of the dry forms should be used at 5 in 100. Fermate showed some indication of controlling scab, but was in no way as specific for *V. inaequalis* as it was for cedar rust [*Gymnosporangium juniperi-virginianae*]. A ground treatment of ½ per cent. elgetol so reduced the carry-over of scab in a McIntosh orchard that five applications of lime-sulphur gave 95 per cent. clean fruit, though the same treatment on the same farm gave only 60 per cent. clean fruit without the ground treatment. Against cedar rust in the Hudson Valley fermate was effective in the field at a concentration of ½ in 100, greenhouse tests indicating that an even lower concentration may be practical.

Copper materials used against cherry leaf spot [*Coccomyces hiemalis*: ibid., xxi, pp. 245, 442, 464] that previously had given the least copper injury or yellow leaf, during the period under review gave the most. The ill effect was plainly due to arsenical injury, confirming the view that some of the insoluble forms of copper act as arsenical correctives and that copper injury is greatest when temperatures are high. Plots sprayed with Bordeaux mixture continued to give small fruits. It would seem that any one of the four pre-harvest sprays can reduce yield. The lime in Bordeaux mixture (1½–6–100) should be reduced to 3–100 and should be eliminated from bordow in the second maggot spray. Fermate, which gave good control of cherry leaf spot, and kept the foliage on the trees later in the autumn than other treatments, was also found to be a good pre-harvest spray against brown rot [*Sclerotinia fructicola* and *S. laxa*]. The use of soluble cottonseed oil with the fermate appeared to be of value in preventing fruit crack.

In an attempt to discover a fungicide able to protect peach trees against infection

through normal wood, wounds, or arsenical injuries by *Valsa* fungi [*V. cincta* and *V. leucostoma*: ibid., xvi, p. 821], it was found that Bordeaux (1½–16–100) can be tolerated for one application at least, though insoluble copper materials were injurious. Zinc sulphate-lime (1½–8–100; 5–8–100 standard recommendation) was a better arsenical corrective than lime 16–100, an important item in the control of these fungi. Elgetol, even at 1 per cent., was ineffective against dormant cankers.

Spraying peaches during blossoming against brown rot [*S. fructicola*] is quite feasible, and is believed to be more suitable than spraying in the pink stage, though infection can occur during the latter.

In experimental plots a low dosage of Bordeaux mixture (not over ½ lb. of actual copper per 100 gals.) continued to give adequate control of vine black rot (*Guignardia bidwellii*), downy mildew (*Plasmopara viticola*), and powdery mildew (*Uncinula necator*). The use of the hooded boom for spraying grapes is a major advance in technique.

Further work on raspberry spur blight (*Didymella applanata*) control indicated that the application of 1 per cent. elgetol should be made as late as possible, though injury may result if the buds are out more than ½ in. Lime-sulphur (1–10) or 1 per cent. elgetol solution gave satisfactory control of raspberry anthracnose (*Plectodiscella veneta*); the spray should be deferred until the buds show at least ¼ in. of green.

Commercial control of the currant leaf spot diseases caused by *Mycosphaerella grossulariae* and *Pseudopeziza ribis* resulted when 70 per cent. of the leaves remained on the bushes until 1st October. Three years' investigations demonstrated that this can be accomplished by spraying when the fruit is half-grown and after it has been picked. Bordeaux mixture (3–3–100) gave excellent results, and left no objectionable residue on the fruit. Some insoluble copper compounds were good, but not better than Bordeaux mixture.

Three years' work showed that a schedule of two sprays controls gooseberry powdery mildew [*Sphaerotheca mors-uvae*] and the leaf spots *M. grossulariae* and *P. ribis*. The first, consisting of lime-sulphur (1–50) should be made immediately after blossoming, and the second, consisting of Bordeaux mixture (6–10–100), after the fruit has been harvested. No insoluble copper compound tested gave consistently such good results as lime-sulphur. In some seasons yellow cuprocide plus cottonseed oil gave as good control of mildew as did the lime-sulphur, but in dry seasons lime-sulphur gives much better control of mildew than does a copper fungicide. As lime-sulphur does not control the leaf spots, a copper fungicide must be used for the second application.

In spite of the dry season seed treatment of peas gave average yield increases of 200 to 470 lb. of shelled peas per acre. Spergon again gave good results on the Surprise, Wisconsin Early Sweet, Gradus, Alderman, and Green Admiral varieties. It also increased the yields of Alaska peas in one field by 300 lb. per acre in duplicate tests. These results were due to fungicidal efficiency combined with growth-stimulating properties.

In New York State the following organisms (in descending order of importance) are primarily responsible for diseases of peas: *Fusarium solani* var. *martii* f. 2, *Pythium ultimum*, *Rhizoctonia* [*Corticium*] *solani*, and *Ascochyta pinodella* [see above, p. 285]. The organisms and the diseases due to them occurred in soils with P_H ranging from 5·4 to 7·48. Six years' investigations of conditions in fields on the Station's canning crop farm at Geneva, where peas have been grown for 16 years, showed that the important root-rot organisms were not completely eliminated by a four- or five-year rotation. Commercial yields were obtained in favourable seasons on suitably fertilized fields in spite of the presence of the pathogens, indicating that their population had been reduced by the rotations to a point where

commercial yields became possible. The importance of a crop rotation and the proper maintenance of a high fertility level was indicated.

Treatment of Lima bean [*Phaseolus lunatus*] seed with spergon increased emergence by 5 to 10 per cent. and yields by 100 to 700 lb. of shelled beans per acre. New improved semesan jr. appeared in these tests to be safe and effective. Tetramethyl thiuramdisulphide gave distinct promise as a seed protectant in greenhouse tests, and did not injure Lima beans.

In spite of the dry season, treatment of maize (sweet corn) seed with new improved semesan jr. and spergon increased emergence by 2 to 10 per cent. and yields by 200 to 300 lb. of green corn [per acre] in commercial fields.

Field tests with commercial stock of cabbage resistant to yellows [*F. conglutinans*] proved the high quality and resistance of the varieties Jersey Queen, Wisconsin Golden Acre, Racine Market, Marion Market, Early Copenhagen Resistant, All Head Select, Wisconsin All Season, and Wisconsin Ballhead. Wisconsin Hollander and Wisconsin Hollander No. 8 showed reduced resistance in hot weather. The newer selections of Wisconsin All Season appeared to possess greater resistance than those of previous years.

Treatments of Lima bean seed (to improve stands and increase yield) with copper oxide (red and yellow), copper oxychloride sulphate, vasco 4, graphite, sanoseed, formacide, barbak, new improved semesan jr., spergon, and other materials showed that all the copper compounds and barbak C caused hardening of the seed coat and stunting in the early stages of growth, at all dosages tested. Semesan jr. and spergon were not injurious and were the only treatments that improved stand, but even these materials gave only erratic results, and seldom increased the yield of marketable beans, based on weight. In spraying and dusting tests satisfactory control of downy mildew [*Phytophthora phaseoli*: ibid., xxi, p. 478] was given by copper sprays (yellow cuprocide, copper oxychloride, copper oxychloride sulphate, tribasic copper sulphate, and Bordeaux mixture, 4–4–50 and 4–2–50) and copper dusts (copper-lime 20–80, tribasic copper sulphate, copper oxychloride, and cuprocide G.A.). The dusts were as effective as the sprays.

C. solani was more frequent in the pea seed of the 1941 crop than in 1938, 1939, or 1940, and caused severe injury in a few samples. *Sclerotinia sclerotiorum* was occasionally found on pea seeds. *A. pisi* and *M. pinodes* were present on 2 per cent. of the pea seed lots submitted for germination tests.

Chloranil (or spergon) gave moderate control of *Rhizopus nigricans* and *Penicillium* spp. on various seeds, flour, talc, or 'phosphate fumes' being used as diluent. Melon seeds are sensitive to this chemical, though pea, bean, and maize seed tolerate excessive dosages. An organic formaldehyde, U.S.R. No. 601, gave promising results in mould elimination from melon seeds on which a mixture of 3 parts talc and 1 part No. 601 was effective and non-injurious. U.S.R. No. 604 was not highly fungicidal on levels safe for melon, maize, and pea seed.

Du Bay 1228 E, as dip or dust, was very effective against moulds of fleshy seeds. Du Bay 1205 FF or tetramethyl thiuramdisulphide did not consistently eliminate moulds; no phytotoxicity was observed, whatever the dosage. A dust, IN 870 A3 (fermate), gave slight control of moulds and bacteria, but was not comparable with new improved ceresan in this respect. Beta-chlorethoxyethyl hydroxide as 4 per cent. concentration in talc proved to be an excellent fungicide. Supplied by the American Cyanamid and Chemical Corporation, as 154–6B, it was effective also against grain smuts.

Several of the newer materials, used for seed treatments in the field, such as spergon, 1205 FF, U.S.R. No. 604, 154–6 B, and Du Bay 1228 E were as good as, or even better than, the standard treatments. Spergon and 1205 FF, when applied to sweet corn, were much better than semesan jr. or barbak D; they appeared also

to afford protection against insects. As these materials contain no heavy metals, their use in place of copper and mercuric compounds helps to conserve valuable war materials. The mercurials 154–6 B and 1228 E proved very effective against grain smuts, but when mercury was of paramount importance in a treatment, they were inferior to new improved ceresan.

On p. 29 of this report it is stated that fineness of particle is directly related to the adhesiveness of fungicides in spray residues. Soy-bean protein and vegetable or mineral oils are the best stickers. The use of a new type of duster, in which a little oil is vaporized on to the dust as it leaves the nozzle, greatly increased the deposition and retention of sulphur dusts.

Bortels (H.). **Meteorobiologische Reaktionen einiger Mikroorganismen.** [Meteorobiological reactions of some micro-organisms.]—*Zbl. Bakt.*, Abt. 2, cv, 17–19, pp. 305–325, 3 figs., 32 graphs, 1942.

The results of the writer's experiments with a number of micro-organisms demonstrated a clear connexion between the rate and completeness of their biological processes and the prevailing meteorological conditions, activity being depressed by cyclonic states and stimulated by anti-cyclones. Among the observations made were some dealing with the influence of the weather on the intensity of 'star' formation in crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.* xxi, p. 444], the number of zoospores produced by the potato blight fungus (*Phytophthora infestans*), and the swarming of various bacteria, including *Pseudomonas tabaci* and *P.* [*Xanthomonas*] *medicaginis* var. *phaseolicola*, the agents, respectively, of tobacco wildfire and grease spot of beans [*Phaseolus vulgaris*].

During the transition from cyclonic to anti-cyclonic conditions, 'stars' were formed more rapidly and by a larger number of individuals of *Bact. tumefaciens* than under the reverse conditions, which, in fact, entirely inhibited this mode of development during the period of 24 hours fixed for the tests.

Notwithstanding certain experimental discrepancies, it appears to be certain that zoospore production in *Phytophthora infestans* increases with rising barometric pressure and sinks to a minimum simultaneously with, or a day before, a fall presaging relatively cool and very rainy conditions. The optimum temperature for the liberation of the zoospores from the sporangia was shown to lie round about 13° C., probably fluctuating between 10° and below 15°.

The intensity of swarming of *X. tabaci* and *X. medicaginis* var. *phaseolicola* was reduced by the presence of clouds and enhanced by their absence.

Riker (A. J.). **Inoculations with bacteria causing plant disease.**—Pure Culture Study of Bacteria (formerly Continuation Service of the Manual of Methods), ix, 2, Leaflet x, pp. x_{41}–3–x_{41}–13, 1941.

This leaflet, one of a series compiled and edited by the Committee on Bacteriological Technic of the Society of American Bacteriologists, was prepared in collaboration with P. A. Ark, Charlotte Elliott, E. M. Hildebrand, and J. G. Leach. It is a second edition of one issued in 1938, which has been largely rewritten and is now brought up to date. It treats briefly of methods for studying the pathogenicity of bacteria in plants and for making certain related investigations. None of the directions are intended to apply to bacteria as a whole: the methods selected are to be regarded only as guides for the beginner, and are to be modified as the circumstances demand. The points covered include simple representative inoculation methods for the inoculation of soil or seed, for inoculation by spraying, through wounds, by insects, with brief reference also to methods for use with fungi, and with viruses, treatment with bacterial products, antibody production, strain variations, the action of pathogens together, use of exogenous cultures, relative

efficiency in technique, making records, and the interpretation of results. A bibliography of 23 titles is appended.

HUMPHRIES (E. C.). **Wilt of Cacao fruits (Theobroma cacao). I. An investigation into the causes. II. A preliminary survey of the carbohydrate metabolism with special reference to wilt susceptibility.**—*Ann. Bot., Lond.*, N.S., vii, 25, pp. 31–61, 11 graphs, 1943.

It is concluded, from a study conducted in Trinidad from 1939 to 1941 with mature budded and grafted cacao trees and young clonal material, that the disorder referred to as cacao fruit wilt and characterized by the presence of young withered fruits of various sizes on cacao trees, is a physiological trouble primarily due to nutrient and water deficiency. Wilting affected fruits of all sizes up to roughly 10 cm. in length and of all ages up to about 70 days and was particularly marked after the appearance of a heavy flush of new leaves. Beyond this critical size the fruits survived unless attacked by pathogenic organisms. The size at which the fruits wilted became progressively smaller as the season advanced, but increased again after the crop matured. Fruits on the thinner branches, farthest away from the ground, were more easily affected than those on the thicker ones. It was found that cacao fruit is susceptible to wilting during the first phase of its growth cycle, a period of about 75 days, at the end of which the development of the fruit reaches its maximum; the second phase, lasting approximately 95 days, is a period of active metabolism, during which fat, starch, and sucrose accumulate in the seed.

AUSEMUS (E. R.). **Breeding for disease resistance in Wheat, Oats, Barley and Flax.**—*Bot. Rev.*, ix, 4, pp. 207–260, 1943.

In this paper the author reviews, with numerous references to the relevant literature, the results so far obtained in different parts of the world in breeding varieties of wheat, oats, barley, and flax for resistance to the chief fungal diseases by which these crops are attacked. All the information given has been noticed from time to time in this *Review*. A bibliography of 269 titles is appended.

CRAIGIE (J. H.). **Heterothallism in the rust fungi and its significance.**—*Trans. roy. Soc. Can.*, Ser. 3, Sect. V, xxxvi, pp. 19–39, 7 pl., 1942.

The author summarizes some outstanding contributions (the more recent of which have been noticed in this *Review*) to the understanding of heterothallism among the rusts and the significance of the phenomenon in relation to their propagation. The pycnospores of the heterothallic rusts, by diploidizing haploid infections, have been shown to fulfil a useful function in the spread of these organisms. Cytological studies have included the mode of ingress of the pycnospore nuclei into the mycelia of haploid infections and, in part at least, the subsequent course pursued by the nuclei. Crosses have been made between different races in several rusts, e.g., *Puccinia graminis tritici*, *P. triticina*, *P. coronata avenae*, *P. anomala*, and *Melampsora lini*, and new races produced from such unions. In the case of *P. graminis*, partial interfertility has been established in crosses between different varieties, and complete interfertility among crosses between different races within the same variety. Genetical studies have shown that, in general, pathogenic potentialities and uredospore colour are inherited according to Mendelian laws, and that abnormal features tend to appear as a sequel to inbreeding successive generations of some (but not all) races.

Many (probably all) heterothallic rusts comprise a larger or smaller number of physiologic races, differing mutually in one or more factors for pathogenicity. These factors, as well as those governing other characters, become separated in haploid infections of two opposite sexes, so that hybridization affords an

opportunity for their redistribution and recombination, while new features arising through mutation or in some other manner in one race are transmitted to others. Thus, heterothallism constitutes a means of promoting variation among the rusts and thereby providing them with better chances of survival in a changing environment.

A bibliography of 79 titles is appended.

GEDDES (W. F.) & LEVINE (M. N.). **The distribution of thiamin in the Wheat plant at successive stages of kernel development.**—*Cereal Chem.*, xix, 5, pp. 547–552, 1 graph, 1942.

A tabulated progress report is given of the writers' analyses of the distribution of thiamin in Thatcher and Ceres wheat plants at successive stages of kernel development, forming part of a three-year Work Projects Administration co-operative study with the University of Minnesota, initiated in 1940, on the effects of leaf and stem rusts (*Puccinia rubigo-vera tritici* [*P. triticina*] and *P. graminis tritici*) on the agronomic properties of spring wheat, the translocation of plant constituents into the developing kernel, and the industrial quality and chemical composition of the resultant grain. The problem has been approached from two angles, i.e., inhibitive, in which rust epidemics were induced in the early stages of plant growth and arrested at stated periods by sulphur dusting, and preventive, involving the exclusion of the disease by the same treatment until certain stages of plant development were reached, whereupon artificial inoculations were made. The leaf-rust experiments were carried out with Thatcher, which was sown on 25th April and 21st May, and the stem-rust trials with Ceres, planted on the latter date only.

The average incidence of *P. triticina* in the early- and late-sown lots of Thatcher was 11 and 16 per cent., respectively, and of *P. graminis* in Ceres 5 per cent. The thiamin content of the kernels of early-sown Thatcher reached a maximum of 77·4 per cent. on the final date of sampling (1st August), whereas in (*a*) the glumes and rachis and (*b*) stems and leaves, it was highest (15 and 60·3 per cent., respectively), on the first date (8th July), and fell to a minimum of 2 and 20·6 per cent., respectively, on the last. Similar relationships obtained in the late-sown Thatcher and Ceres plants. Pending the completion of assays of plants with varying degrees of severity of rust infection, it may be stated that *P. graminis*, in particular, markedly reduced the translocation of thiamin into the kernels.

REITZ (L. P.), JONES (E. T.), JOHNSTON (C. O.), & PAINTER (R. H.). **Agronomic tests of new resistant varieties and hybrids of hard red winter Wheat in the presence of stem rust and Hessian fly.**—*J. Amer. Soc. Agron.*, xxxv, 3, pp. 216–229, 3 figs., 1 graph, 1943.

In 1940–1 a number of winter wheat varieties and strains were tested in nurseries under three sets of growing conditions, viz., (*a*) generally favourable at Manhattan, Kansas, (*b*) adverse, chiefly on account of stem rust (*Puccinia graminis tritici*) at Ramona, Kansas, and (*c*) in the presence of a large population of Hessian fly, *Phytophaga destructor* (Say) [*R.A.M.*, xx, p. 107], at Springfield, Missouri. The data thus secured on the reactions of the plants to stem and leaf rust [*P. triticina*] and to the fly are discussed and tabulated. The most promising results in respect of resistance to the rusts were obtained with certain Marquillo and Hope hybrids. It is concluded from the quantitative evidence of the trials that inherent resistance to, or tolerance of, the pathogens under observation may confer a considerable measure of protection on winter wheats in the central Great Plains.

ATKINS (I. M.). **Reaction of some varieties and strains of winter Wheat to artificial inoculation of loose smut.**—*J. Amer. Soc. Agron.*, xxxv, 3, pp. 197–204, 1943.

From 1938 to 1941 about 140 winter wheat varieties and strains were inoculated under field conditions at Denton, Texas, with loose smut (*Ustilago tritici*), the annual

loss from which during the period 1931 to 1939 was estimated at 454,000 bush. or 1·8 per cent. of the crop, while the reductions in the more humid central and north-central sections of the State may amount to 5 or 10 per cent., thus assuming considerable economic importance on individual farms. Moore's vacuum spore suspension method [*R.A.M.*, xv, p. 567] was used, and preliminary tests showed that the heads should be inoculated at the early to mid-anthesis stage of growth, any time of day being suitable, regardless of the humidity of the outside air.

None of the commercial hard red winter wheats proved to be resistant, but Pawnee, a new variety now ready for distribution by the Nebraska Agricultural Experiment Station, remained completely free from infection, like its Kawvale parent. A number of Hope × Kawvale selections (hard red) and Hope × Mediterranean (soft red) were also resistant and are likely to be of particular value in view of their simultaneous freedom from leaf and stem rusts [*Puccinia triticina* and *P. graminis*]. Other varieties maintaining a resistant reaction throughout the trials were Forward, Purdue No. 4, Leap, Zimmerman, Purplestraw, Early Premium, and Minhardt (all soft red).

Clark (J. A.). **Registration of improved Wheat varieties, XV.**—*J. Amer. Soc. Agron.*, xxxv, 3, pp. 245–248, 1943.

Two wheat varieties were approved for registration in 1942, namely, Pawnee Reg. No. 330, and Comanche Reg. No. 331, both of the hard red winter type. Pawnee is moderately resistant to bunt [*Tilletia caries* and *T. foetida*], highly so to loose smut [*Ustilago tritici*: see preceding abstract], and either slightly resistant to, or able to escape severe damage from, stem rust [*Puccinia graminis*].

Comanche is highly resistant to many important races of bunt (average infection from 1937 to 1941, 1·5 per cent. compared with 71·4 and 38·1 for Chiefkan and Tenmarq, respectively), fairly so to leaf rust [*P. triticina*], and more tolerant of *P. graminis* than other varieties grown in the central and southern Great Plains.

Rodenhiser (H. A.) & Taylor (J. W.). **The effect of photoperiodism on the development of bunt in two spring Wheats.**—*Phytopathology*, xxxiii, 3, pp. 240–244, 1943.

The spring wheat varieties Canus and Ulka, inoculated with races L–1, L–2, and L–4 of *Tilletia levis* [*T. foetida*] and T–1, T–4, T–9, T–10, and T–12 of *T. tritici* [*T. caries*], were grown under natural and continuous-light conditions in the greenhouse at Arlington Farm, Virginia. In the former series of tests Canus was resistant to all races, while in the latter a marked breakdown in its resistance to the three races of *T. foetida* and to T–4 of *T. caries* was observed. Ulka was completely susceptible to all races but one (T–5) [*R.A.M.*, xxi, p. 329], to which its resistance was lowered by the protracted light treatment.

The maximum incidence of bunt occurred in plants growing at an extremely rapid rate, and it is suggested that the development of the pathogens is favoured by certain nutritional changes in the host induced by its prolonged exposure to light.

Angell (H. R.). **The effects of addition of lime and depletion of soil nutrients on take-all of Wheat.**—*J. Coun. sci. industr. Res., Aust.*, xvi, 1, pp. 18–27, 1943.

To ascertain whether the salts and exchangeable bases in soils influence the incidence of take-all (*O[phiobolus] graminis*) an open-air experiment was carried out in 1938 in which (*a*) 4 kg. hydrated lime, (*b*) 4 kg. ground limestone, (*c*) 0·5 kg. calcium sulphate, (*d*) 1·5 kg. ground magnesite, (*e*) 6·6 gm. potassium carbonate, and (*f*) 116 gm. sodium chloride were added to 5-gal. drums of soil, in which, subsequently, Nahama wheat was sown. Each treatment was applied to six drums. In three drums of each series dead mycelium of the fungus was placed among the

wheat seed, and in three others viable inoculum was used. In 1939 wheat was again sown, and the previous year's procedure followed. In 1940 no inoculum was added. When the seedlings were well established, all but six per drum were discarded. The plants were harvested at maturity, air-dried, weighed, the tillers counted, and the condition of the roots, the average grain weight, and the grade of the grain from each head estimated. In 1941 the procedure of 1940 was again followed.

The results in 1938 were as follows. The seedlings were not obviously affected by inoculation with *O. graminis*. As was observed in other (unpublished) experiments in 1939 and 1940, the seedlings grew best in soil to which potassium carbonate had been freshly added, maintaining their lead until brairding, when the initial advantage disappeared. Symptoms resembling mild toxicity then developed. Typical take-all symptoms subsequently showed up on 18 out of 32 plants, the more nearly normal ears bearing numerous aborted spikelets towards the tips, i.e., showing the condition known as 'tipped ears'. No difference was observed between the behaviour of the plants growing in the drums to which potassium carbonate only was added and that of those in the drums to which potassium carbonate and *O. graminis* were added. Of 31 plants in the latter, 13 appeared to be healthy, while the remainder failed to develop beyond the host stage. The greatest difference between the inoculated and uninoculated plants occurred in the magnesium carbonate series, where, among the former 8 out of 34 heads emerged from the host, as compared with 22 out of 30 in the latter. In the calcium sulphate series, in the uninoculated drums 11 plants died in the host stage, while in the inoculated ones all the plants remained healthy.

In 1939 the dry weight of the plants grown in soil to which hydrated lime, alone or with other bases, was added, was three times that of the plants grown in the control soil. All the plants in the inoculated drums were very severely affected by *O. graminis*, differences in soil treatment exerting no apparent influence on infection.

In 1940 the plants in all the drums to which hydrated lime was added, alone or together with compounds of magnesium, potassium, or sodium, made much better growth than those in drums that received ground limestone, calcium sulphate, ground magnesite, potassium carbonate, or sodium chloride. On 29th October, 60 plants were taken for examination. The worst plant was chosen from each of three drums in each series. Lesions were found on the roots of 22, and *O. graminis* was isolated from seven, three of the seven plants coming from drums into which the fungus had not been experimentally introduced.

At heading, sudden wilting and death from take-all occurred only in two of the drums to which potassium carbonate was added, and in four of the six control drums. As in the previous year, there were marked differences between the effects of the soil treatments, but only hydrated lime caused significant effects on all measures of take-all symptoms, viz., total weight, mean root rating, mean grain weight, and mean percentage of plants in a pot with half or more than half the number of ears containing grain averaging 0·045 g. in weight. According to all measures, there were highly significant differences between drums inoculated in 1938 and 1939 and the uninoculated ones, the plants in the former being superior and less affected by disease. This unexpected result was also obtained in three other (unpublished) experiments. In 1941, the results resembled those obtained in 1940. The only important effects were again observed in the drums to which hydrated lime was added.

Thus, in three consecutive years, the effects of *O. graminis* on wheat grown in soil containing an excess of hydrated lime were consistently much less noticeable than they were in the same soil without lime. This effect would appear to be due to increased availability of some nutrient, the vigorous plant growth so induced

adding to the resistance of the plants. The supply of nutrients made available year after year is reflected in the relatively improved growth and yield of the later years. Further evidence in support of this view is supplied by the striking difference in growth between the plants in the inoculated and uninoculated drums during the second year. The development of the plants and the amount of take-all injury were almost the reverse in the second year of what they were in the first. The plants in the drums inoculated during the previous year were thriving and healthy, while those in the uninoculated ones were extensively diseased. The influence of nutrient availability on infection by *O. graminis* needs further critical study.

Russell (R. C.). **The relative importance, from the pathological standpoint, of two types of smudge on Wheat kernels.**—*Sci. Agric.*, xxiii, 6, pp. 365–375, 1 pl., 1943.

Two types of smudge are present on wheat kernels in Saskatchewan, referred to as 'mild' and 'severe'. In the former the discoloration centres on the embryo and does not appear on the ventral side, while in the latter it is darker and does not extend so far from the tip of the kernel, where it appears on both the ventral and dorsal sides. Kernels showing the mild type are well filled, while those affected with the severe type are usually shrunken and may be bleached. In the samples examined the mild type was about ten times as common as the severe. Tests showed that apparently clean seeds and those with the mild type of smudge carried little infection by *Helminthosporium sativum*, while seeds with severe smudge produced *H. sativum* on a high percentage of the kernels.

In a greenhouse test Apex wheat seed, clean, with mild smudge, and with severe smudge gave, respectively, 93·4, 94·6, and 82 per cent. total emergence, and 5·4, 3·6, and 16 per cent. pre-emergence blight, while the dry weights of the seedlings were 1·224, 1·344, and 1·032 gm.; the corresponding figures for Regent seed were 92, 87·4, and 74·6 per cent. total emergence, 4·4, 7·6, and 16·4 per cent. pre-emergence blight, and 1·026, 1·036, and 0·822 gm. dry weight.

Apex seed with mild smudge, untreated and treated with ceresan gave, under greenhouse conditions, 92 and 97·3 per cent. total emergence, respectively, and 5·7 and 2·3 per cent. pre-emergence blight, the corresponding figures for severely smudged seed, being 65·3 and 99 per cent. and 22 and 0·3 per cent. No smudge appeared in the grain of plants grown in the greenhouse from slightly or severely smudged seed.

In a field test carried out in 1942, three samples each of clean, mildly, and severely, smudged seed, averaged, respectively, 92·3, 85·6, and 64·9 per cent. emergence, and 223·9, 221·9, and 173·2 gm. yield of grain.

These studies are considered to have a direct, practical application to the testing of seed wheat. The two types of smudge can be recognized by visual examination. The mild type is of only slight importance, while the presence of the severe type is a reliable indication of infection by *H. sativum*, and grain showing appreciable amounts of it should not be used for seed unless treated with a suitable fungicide, such as ceresan.

Gorter (G. J. M. A.). **Disinfecting winter cereal seed against smut and other diseases.**—*Fmg S. Afr.*, xviii, 204, pp. 187–188, 1943.

The author recommends agrosan G or ceresan as the most suitable materials for the disinfection of cereal seed-grain against fungal diseases in general. Brief directions are given for their use. The paper concludes with instructions for applying the hot-water method of treating wheat and barley seed against loose smut [*Ustilago tritici* and *U. nuda*, respectively]. Treated seed should be planted in a small plot so situated that spores from infected crops cannot be blown on to

it; the seed collected from this plot should be quite clean, and can be used for planting the following season.

TAPKE (V. F.). **Occurrence, identification, and species validity of the Barley loose smuts, Ustilago nuda, U. nigra and U. medians.**—*Phytopathology*, xxxiii, 3, pp. 194–209, 4 figs., 1943.

In a study of the different kinds of barley loose smut 500 specimens collected from 33 States of the American Union were uniformly germinated on 2 per cent. potato dextrose agar at 20° C. Six of these were heterogeneous types, while of the remainder, all of which were characterized by the loose type of smutted head and echinulate spores, 192 produced the mycelial germination of *Ustilago nuda*, 209 the sporidial germination of *U. nigra* [*R.A.M.*, xx, p. 296], and 93 a mixture of the two forms, those of the last-named also conforming in other respects to the description of *U. medians* [ibid., xviii, p. 388]. On further investigation, however, the representatives of this group were found to be merely combinations of *U. nuda* and *U. nigra*, there being apparently no separate species agreeing with the diagnosis of *U. medians* either in the United States or elsewhere.

When spores of *U. nuda* and *U. nigra* are uniformly germinated on 2 per cent. potato dextrose agar or other standard media, the former species consistently produced only hyphae and the latter exclusively promycelia and sporidia. By this means it can thus be rapidly and reliably ascertained whether (1) the pathogen is *U. nuda*, *U. nigra*, or a mixture of the two, and (2) the mode of seed treatment requisite to ensure control. Comparative chlamydospore germination tests of *U. nigra*, *U. avenae*, *U. levis* [*U. kolleri*], and *U. hordei* on ten different media at 20° C., and on 2 per cent. potato dextrose agar at a range of 5° to 40° yielded conclusive evidence that the first-named is a true sporidia-producing smut comparable to the other three.

Specific incidence in the present study denotes that the distribution of *U. nigra* in the United States has become as extensive as that of *U. nuda*. Half the computed annual 2,000,000 bush. loss attributed to barley loose smut may therefore be prevented by simple and inexpensive seed treatments [ibid., xv, p. 211].

With the exception of occasional hybrid types, such as occur also in the wheat and oats smuts, loose smut of barley in the United States may, on the basis of these investigations, be referred either to *U. nuda* or *U. nigra* which are readily differentiable, e.g., by the spore germination test. *U. nigra* is a valid species, an amplified diagnosis of which is given. *U. medians*, on the contrary, appears to have been erroneously based by Biedenkopf (*Z. PflKrankh.*, iv, pp. 321–322, 1894) on a mixture of two distinct smuts, and the binomial is therefore rejected.

IMMER (F. R.), CHRISTENSEN (J. J.), & LOEGERING (W. Q.). **Reaction of strains and varieties of Barley to many physiologic races of stem rust.**—*Phytopathology*, xxxiii, 3, pp. 253–254, 1943.

Two barley varieties, Peatland C.I. 452 and Chevron C.I. 1111, and 20 hybrids, normally resistant to stem rust in the field, and two varieties ordinarily susceptible to the disease, Barbless C.I. 5105 and Minnesota 462, were tested at the Minnesota Agricultural Experiment Station in the seedling stage for their reactions to 19 physiologic races of *Puccinia graminis tritici* and one collection of *P. g. secalis*.

The varieties and hybrids that were resistant in the field showed a similar response as seedlings to all the races of *P. g. tritici* except 29, as well as to *P. g. secalis*, while the two susceptible varieties reacted comparably to all the races of *P. g. tritici* but proved resistant to *P. g. secalis*. Race 29 attacked all the varieties and strains in the seedling stage, and six tested at maturity were also susceptible.

It is apparent from these data that the seedling reaction to rust, being of a

physiological nature, is similar at all stages of growth, and therefore affords a reliable means for the early elimination of susceptible lines.

Weimer (J. L.). **Anthracnose of Lupines.**—*Phytopathology*, xxxiii, 3, pp. 249–252, 1 fig., 1943.

The fungus isolated on oats agar from stunted, malformed, stem-girdled, and cankered lupin (*Lupinus angustifolius*) seedlings at Quincy, Florida, in March 1939, was compared with a culture of *Glomerella cingulata* from apple and identified with that organism. The plants are attacked under conditions of high humidity, the young leaflets, petioles, stems, and cotyledons being susceptible. Infection may also occur on the underground portion of the hypocotyl, but the main stem is seldom invaded, except at the apex or through the cotyledons or branches. Inoculation experiments on *L. albus* leaves resulted in severe injury, but *L. luteus* remained free from infection in the one test in which it was included. This is stated to be the first record of *G. cingulata* on lupins in the United States.

Stanton (T. R.). **Registration of varieties and strains of Oats, XII.**—*J. Amer. Soc. Agron.*, xxxv, 3, pp. 242–244, 1943.

Since the publication of the last report on the registration of improved varieties of oats [*R.A.M.*, xxi, p. 330], two further varieties have been submitted and approved, namely De Soto [ibid., xxii, p. 94] (mid-season yellow), resistant to crown rust [*Puccinia coronata*], smut [*Ustilago avenae* and *U. kolleri*], and cold, and Bridger, which is derived from a cross between Markton and Victory and combines the superior agronomic qualities of the latter with the smut resistance of the former parent.

Bremer (H.). **An American Oat disease found in Western Anatolia.**—*Phytopathology*, xxxiii, 2, pp. 165–167, 2 figs., 1943.

The fungus isolated from the ill-defined, oblong, whitish to yellowish, red-bordered spots on the leaves of autumn-sown oats at the Bornova Plant Protection Station, Western Anatolia, Turkey, in March, 1938, was identified on the basis of its morphological, cultural, and pathogenic characters, as *Pseudodiscosia avenae*, hitherto recorded only from Oregon and Washington [*R.A.M.*, xix, p. 74]. The bi-, rarely tri-septate, hyaline, fusiform, slightly curved conidia of the Turkish fungus measured (with cilia) 23 to 45 by 3 to 4·5 (average 34·2 by 3·6) μ, the length without cilia being 15 to 27 (20·4) μ. A single cilium occurred at each end, one long and thick, the other short and slender. Very slow growth was made on carrot and potato dextrose agars and carrot slices. As in the United States, the leaf spot is correlated in Turkey with the cool, damp weather of early spring, disappearing after the beginning of April. It was again observed at Bornova in 1939 and 1940, but caused little damage. A wild grass, possibly *Avena sterilis*, on a mountain slope near Kemelpasa, some 35 km. from Bornova, was found to harbour a fungus apparently identical with *P. avenae*, having conidia (including cilia) measuring 24 to 39 by 4 to 5 (average 33·3 by 4·25) μ, the length without cilia being 18 to 23 (19·9) μ. It seems probable, therefore, either that the fungus is a native of Turkey which was accidentally introduced into the States, or else that its geographical range is much wider than is known on the basis of the available information.

Value of seed dressing.—*Fertil. Feed St. J.*, xxix, 5, p. 106, 1943.

In recent trials in Berkshire, Yielder oats seed-grain treated against leaf stripe [*Helminthosporium avenae*: *R.A.M.*, xxii, p. 128] with an organo-mercurial dressing yielded (on an average of three tests) 31·4 cwt. per acre compared with 28·4 cwt. for the controls. Even in a dry season the disease may attain epidemic proportions in the ripening crop, thereby endangering the health of any stands grown from

home-saved seed. An important result of these experiments was the evidence obtained concerning the heavy losses due to 'pre-emergence blight', which is the real cause of troubles commonly assigned to other factors. Severely blighted seedlings are swollen, contorted, and without sufficient vigour to emerge from the soil, while those which succeed in doing so are liable to infect the entire crop, especially under humid conditions. The wisdom of the cheap and simple precaution of applying an organo-mercurial preparation (likewise effective against barley leaf stripe [*H. gramineum*]) to the seed before sowing is thus apparent.

Zade (A.). **En enkel snabbmetod för prövning av betningsmedlens verkan mot Havreflygsot, Ustilago avenae (Pers.) Jens.** [A simple and rapid method of testing the effect of fungicides on loose smut of Oats, *Ustilago avenae* (Pers.) Jens.]—*Nord. JordbrForskn.*, xxii, 7–8, pp. 244–255, 1940 (issued 1941). [German summary.]

A reliable estimate of the toxicity of fungicides to loose smut of oats (*Ustilago avenae*) can only be made on the basis of seed-grain with a minimum of 20 per cent. infection, an incidence ordinarily to be secured exclusively by means of inoculation, for which purpose the evacuation method [*R.A.M.*, xii, p. 431] is employed. The fungicides are tested by a procedure which has been found to be more rapid and convenient than the so-called 'Leipzig method' [ibid., x, p. 92]. The preparations are applied according to the prescribed directions, 50 seeds sufficing for each sample; however, since the treatment of such small quantities presents technical difficulties, seed-grain of another colour (black if the lot to be tested is pale) is added as a makeweight and discarded on completion of the steeping. The treated seeds are germinated in the ordinary way on moist blotting paper (saturated to 70 per cent. of its water-holding capacity). After 18 to 24 hours five seeds are removed from each batch, dehulled, and deposited on a slide after a thorough shaking in water. If the spores adhering to the caryopses are shown by microscopic examination to have germinated, the particular preparation under observation has evidently failed to penetrate the glumes, this being the critical factor in the matter of evaluation. On the other hand, the fungicides that have prevented spore germination may be regarded as effective for the object in view. After three or four days have elapsed the loss of viability may be safely presumed.

The results of laboratory tests by this method, which were confirmed by three years' field trials, show that the most uniformly toxic of the various treatments was immersion in mercuric chloride-formalin. Thus, in 1936, 1937, and 1938, the incidence of infection in the Svalövs Goldregen variety was reduced from 89·5, 84, and 65·9 to 0·2, 0·9, and 0·8 per cent., respectively, the corresponding figures for Orion being from 59, 69, and 59 to 0·2, 0·4, and 0·1, respectively. Immersion in formalin alone also gave very good results, the amount of smut in Goldregen treated with this fungicide during the three experimental years being 0·4, 1·3, and 1·8, respectively, and in Orion 0·3, 1, and 1·1, respectively, while the corresponding figures for germisan nassbeize were 0·8, 2, and 2·6, respectively, in Goldregen and 0·5, 2, and 4, respectively, in Orion. Dusting with ceresan only reduced infection in Goldregen to 4·9, 6·6, and 5·0 per cent., respectively, in 1936, 1937, and 1938, the corresponding figures for Orion being 4·0, 8·3, and 7·7, respectively.

A close parallel was observed between *U. avenae* and *Helminthosporium gramineum* in respect of their reactions to the various fungicides, depth of penetration clearly being the operative factor in either case.

Mukerji (B.) & Dey (N. K.). **Assay of Indian ergot.**—*Curr. Sci.*, xii, 3, pp. 87–88, 1943.

Particulars are given of the botanical, chemical, and pharmacological assays of an ergot [? *Claviceps purpurea*] specimen cultivated on K. M. Thomas's rye plots

in the Nilgiri Hills by Hynes's method [*R.A.M.*, xxi, p. 135] at the Biochemical Standardization Laboratory of the Government of India, Calcutta. A. B. Bose, who was responsible for the botanical study of the specimen [ibid., xxii, p. 166], found that the average length of the sclerotia was 2 to 3 cm., with a minimum of 1 cm., their diameter being 4 to 5 mm. Some of these organs are cylindrical, with a thick base and subacuminate tip, while others are conspicuously curved; the yellowish core is surrounded by a dark-coloured hard exterior, which was shown by transverse sections to consist of small, dark cells, turning brownish-red on contact with sulphuric acid, the inner portion being constituted by subhyaline, densely aggregated, minute, oval or rounded cells. The length of the subcylindrical, slightly curved, longitudinally furcate sclerotia of material of *C. purpurea* imported from Europe, was determined by I. B. Bose as 1 to 3 cm.; their pinkish cores are surrounded by a dark brown exterior. Transverse sections revealed an appearance similar to that of the Indian sample.

The water-soluble and water-insoluble alkaloid contents of the Indian specimen, calculated as ergometrine and ergotoxin-ergotamine, respectively [ibid., xv, pp. 154, 720], were estimated (with the assistance of N. K. Dutt and B. Chowdhury) as 0·0237 and 0·1169 per cent., respectively. The ergot is therefore considered to be of good quality and compares favourably with many batches of imported ergot.

Plante (Enid C.) & Sutherland (K. L.). **Separation of ergot from Rye Corn.**—*J. Coun. sci. industr. Res. Aust.*, xvi, 1, p. 28, 1943.

In Australia crops of rye corn containing 4 per cent. ergot [*Claviceps purpurea*] are being grown, and the problem is to remove the 96 per cent. of grain so that the final product does not contain more than 2 per cent. organic impurity. Density separations having proved unsatisfactory, the authors have attempted separation by using the surface properties of the two grains. An emulsion of purified paraffin oil, the droplets of which adhere to and spread over the waxy, hydrophobic rye surface, but do not adhere to the hydrophilic ergot surface, is added to the grain-ergot mixture. This oiled grain can be efficiently separated in a flotation cell, which should be of the pneumatic type to provide gentle agitation and good air dispersion. This produces an ergot product containing 1 per cent. or less of impurity with 95 per cent. or better recovery. The cost of separation is estimated at 3*d.* per lb. of ergot.

Niccolini (P.). **Über einen hypotensorischen Wirkstoff von Ustilago maydis.** [On a hypotensory active principle of *Ustilago maydis*.]—*Arch. ital. Sci. farmacol.*, xi, pp. 137–152, 1942. [Abs. in *Chem. Zbl.*, cxiv (i), 9, p. 965, 1943.]

At the Pharmacological Institute of the University of Sienna the author extracted from dried maize smut (*Ustilago maydis*) [*U. zeae*] balls, with distilled water containing 0·1 per cent. glacial acetic acid and 0·5 per cent. chloroform, a substance presenting several analogies with acetylcholin and exciting a marked reduction in the blood pressure of experimental animals (rabbits) by way of the parasympathetic nerve endings.

Margolin (A. S.). **The carbohydrate requirements of Diplodia macrospora.**—*Proc. W. Va Acad. Sci.*, xiv, pp. 56–59, 1940. [Received April, 1943.]

Diplodia macrospora [a pathogen of maize] has been reported as incapable of growth on dextrose but able to develop satisfactorily on sucrose [*R.A.M.*, xxi, p. 330]. In the writer's experiments, however, the fungus grew equally well on a synthetic medium containing dextrose, sucrose, or maltose at the rate of 20 gm. per l., provided the essential auxithal, biotin or an analogous substance, was added to the substratum at a concentration of 0·1 gm. per l. In the absence of the growth substance there was little or no growth on any of the sugars. The vigorous

development of *D. macrospora* on brown sugar is attributed to the presence of an auxithal as a contaminant, since purification of the sugar with norit (activated charcoal) resulted in a significant decrease in its capacity to support growth, which was restored by the addition of biotin to the medium.

MARCHIONATTO (J. B.). **El 'moho' del Maiz.** [The 'mould' of Maize.]—Reprinted from *J. agron., B. Aires, 1941*, 8 pp., 3 col. pl., 4 figs., 1942. [English summary.]

Aspergillus flavus was found to be the predominant mould affecting stored maize in the Argentine [*R.A.M.*, xxi, p. 413], other fungi present being *Rhizopus nigricans* [*R. stolonifer*], *Fusarium moniliforme* [*Gibberella fujikuroi*], *Aspergillus herbariorum* [*A. glaucus*], *A. fumigatus*, *Penicillium viridicatum*, *P. olivinoviride*, and *Diplodia zeae*. *A. flavus* specifically attacked the albumin and under laboratory conditions its development was suppressed by dusting the seed-grain with 2 per cent. crystallized silex.

PORTER (C. L.). **Fungus development as affected by carbon and nitrogen sources.**—Abs. in *Proc. Ind. Acad. Sci.*, l, p. 57, 1940.

Among other fungi *Diplodia zeae* was grown on a basic medium consisting of magnesium sulphate, ammonium nitrate, dihydrogen potassium phosphate, and a source of carbon, the substratum being sterilized in a water bath at 68° C. on three consecutive days. The best sources of carbon were dextrin and inulin, while urea, nucleic acid, and cystine gave satisfactory supplies of nitrogen.

BAIN (D. C.) & EDGERTON (C. W.). **The zonate leaf spot, a new disease of Sorghum.**—*Phytopathology*, xxxiii, 3, pp. 220–226, 3 figs., 1943.

Technical descriptions [but no Latin diagnoses] are given of *Gloeocercospora* n.g. and its type species, *G. sorghi* n. sp., the agent of a widely distributed leaf spot of sorghum, Johnson grass (*Sorghum halepense*), and Sudan grass in southern Louisiana, and observed also on the C[anal] P[oint] sugar-cane variety and maize. The disease was at first confused with that caused by *Titaeospora andropogonis* [*R.A.M.*, xxi, p. 286] from which *G. sorghi* differs, however, in its unbranched conidia, which are hyaline (salmon-pink in the mass), pluriseptate, elongate to filiform, 20 to 195 by 1·4 to 3·2 (average 82·5 by 2·4) μ, and borne in a slimy, pink matrix on hyaline, septate, simple or branched conidiophores, 5 to 10 μ in length. Black, lenticular to spherical, sclerotia, 0·1 to 0·2 mm. in diameter, occur in profusion in the necrotic host tissues. The salmon-pink sporodochia, which are situated on the leaf surface between the guard cells and above the stomatal apertures, arise on more or less well-defined stalks from hyaline, septate, branching hyphae emerging from the stomata.

The colour of the lesions produced by *G. sorghi* varies according to their size, usually being light brown with a light to dark red margin in the smaller spots, while in the larger ones dark and pale zones alternate. The infected areas, which are found along the margins or towards the midrib, may coalesce into semicircular or irregular blotches, sometimes covering the entire leaf.

Specimens of the pathogen on *S. halepense* and sorghum have been received from Mississippi, on Sudan grass from Virginia, and on sorghum from Florida, while the fungus attacking *Agrostis* seedlings in Pennsylvania is also apparently the same.

MELCHERS (L. E.) & HANSING (E. D.). **The effect of Sorghum kernel smuts on the development of the host.**—*J. agric. Res.*, lxvi, 4, pp. 145–165, 7 figs., 1943.

In investigations conducted from 1929 for seven years at Manhattan, Kansas, the effect of the kernel smuts, *Sphacelotheca sorghi* and *S. cruenta* [*R.A.M.*, xx, p. 160], on the development of the host was studied on 25 varieties, selections, and hybrids of sorghum. It was found that host varieties reacted differently to the two smuts, but in general they were more strongly affected by *S. cruenta* than by

S. sorghi. Thus, in the *S. sorghi* series, the average reduction in the height of the plant was 2 per cent., in the diameter of the stalk 18 per cent., and in the leaf width of diseased plants 16 per cent. as compared with normal plants, while the corresponding reductions in the *S. cruenta* series, races 1 and 2, were 19 and 18 per cent., 38 and 27 per cent., and 33 and 23 per cent., respectively. The reductions effected by both smuts are considered of economic importance since they lead to reduced tonnage of grain and forage.

The reduced height of infected plants was found to be due partly to shortened internodes, but mainly to a reduced number of internodes. Plants attacked by *S. cruenta* had fewer nodes (in several cases only half as many as healthy plants) than those attacked by *S. sorghi*. The following explanation is advanced for this reduction: the invasion of the apical meristematic tissue of the plant by the smut fungi affects the metabolism of the plant, possibly by means of a chemical stimulus, in such a way that it forms fewer nodes prior to the differentiation of the panicle than does a normal plant; consequently, the infected plant heads earlier and is thus dwarfed primarily owing to a reduced number of internodes. The extent of node reduction was found to vary in different varieties or strains of the host, as also the response in the same variety or strain of the host varied with different races of the two smuts.

Plants attacked by *S. cruenta* grew more rapidly, heading from a few days to about a fortnight earlier than normal plants, whereas plants attacked by *S. sorghi* headed approximately at the same time as healthy ones. Plants of all 25 varieties tested had an average of 1·4 tillers over the normal, when attacked by *S. cruenta* race 1 and 0·6 when attacked by race 2; those attacked by *S. sorghi* had 0·5 tillers over the normal. This tendency of smutted plants to tiller excessively was very pronounced in certain varieties. Some varieties of sorghum infected with *S. cruenta* produced proliferation of glumes, very striking in the field because of the brush-like appearance and abnormally dark green colour. Infection by *S. sorghi* had no such effect. Considerable variation was observed, in limited experiments, in the size and shape of sori according to the species and race of smut and the variety of sorghum infected. It appeared that kafir × feterita K.B. 2686 when infected with *S. cruenta* race 2 had longer and more curved sori than when attacked by race 1 of this smut or by *S. sorghi*. Infection with either smut led to a partial or complete lack of awn development in the milo group of sorghum and their hybrids.

Sinclair (W. B.) & Lindgren (D. L.). **Ridges and sectors induced in the rind of Citrus fruits by fumigation with hydrocyanic acid.**—*Plant Physiol.*, xviii, 1, pp. 99–106, 3 figs., 1 diag., 1943.

The fumigation of citrus trees in Southern California with hydrocyanic acid for insect control, at certain times of the year and under certain environmental conditions, produces an irregular and excessive growth of the outer peel, known locally as 'ridging' or 'cox-combing'. By tests carried out for over two years in commercial groves in coastal and inland regions, a relation was established between the time of year when fumigation was effected and the amount of fruit damage.

With navel and Valencia oranges and grapefruit the highest percentage of affected fruits occurred when the trees were fumigated in February. Lemon fruits were observed to become severely affected if the trees were fumigated at any time from late January to April, inclusive. It is, therefore, evident that the ridging depends on the stage of development of the fruit buds when fumigation is carried out. If the trees are fumigated before or after this stage is reached, only the natural percentage (0·1 to 1·5) of ridged fruits will develop.

The effect of the hydrocyanic acid is not carried over to the following year, the development of the ridges and sectors is not correlated with fruit size, and the phenomenon is confined to the outer rind (flavedo).

Progress Reports from Experiment Stations, season 1941–42.—183 pp., 1 fig., London, Empire Cotton Growing Corporation, 1943.

These reports [cf. *R.A.M.*, xxi, p. 414] contain, *inter alia*, the following items of interest. At Barberton, South Africa, a further manurial experiment was carried out on premature leaf-fall associated with *Alternaria* sp. In all plots given compost or potash or both, attack by the fungus was retarded by about three weeks. Better growth has been found to delay leaf-fall, but potash produced equal delay in the onset of symptoms, with very slight increase in growth, and lime increased growth appreciably, without affecting leaf-fall. No treatment prevented infection. The plants in the plots receiving potash, lime, and compost gave excellent growth, appeared to be quite healthy before leaf-fall set in, and gave very good yields; yet even they became severely infected, with some loss of late crop.

Further work at Gezira on leaf-curl resistance showed that all the selections of P.S.S. 700 origin were strongly resistant. Except for M.S.D.S. 87/39–5 and 133/39–8, both of which showed a significant degree of resistance, the M.S.D.S. selections became badly affected. With reference to the generally accepted view that leaf curl is sporadic in its occurrence, it is pointed out that in the test under consideration, an alternate host, *Malvaviscus* sp., was present to the east of the plot, the direction of the prevailing wind during early morning in winter and early spring was from north-east to south-west. In general, infection gradually diminished from the north-east to the south-west and it would seem that spread followed the prevailing wind and originated in the garden to the east of the experiment. Furthermore, leaf curl was first observed on the experimental farm in two foci which were to the south-west of the leaf-curl experimental site, and it is, therefore, likely that the original infection would have come from the south-west corner and spread from there, had not spread been determined by the direction of the prevailing wind.

In the Gezira, also, seed of 259 types of dura (*Sorghum* spp.) was inoculated with *Sphacelotheca sorghi* and sown out. Four types failed to germinate, 169 types became infected, 60, which headed normally, did not develop the disease, and 26 failed to form heads and could not be tested.

At Shambat the N.T. 2 and X 1730 strains of the seventh back-cross composition containing blackarm resistance factors B_1 and B_2 were propagated in bulk, ninth back-crosses were grown, and from them seed was produced for next season's propagation plots. This completes the breeding programme for blackarm-resistant Sakel varieties from American Upland (Uganda B. 31) crosses.

Transference of the linked blackarm resistance factors B_2 B_3 from *Gossypium punctatum* to N.T. 2 and X 1730 strains was carried to the sixth back-cross stage. B_3 is semi-dominant, but in the homozygous state is the strongest resistance factor yet found. The task of flagging blackarm-resistant Sakel with *arboreum* gene R (reddish flowers and leaves) was virtually completed.

Twenty American Upland strains were classified on blackarm resistance, and the Uganda variety SP84R was sorted into its resistant and susceptible components, and seed homozygous for B_2 was produced for bulk preparation. A beginning was made towards transferring B_3 to SP84R, 511D, Deltapine, and XA 129, the object being the synthesis of blackarm-resistant American Upland types for Equatoria.

In Uganda blackarm was severe in many parts of Teso District, but at Serere it was not abnormal. Evidence was obtained that lesion counts are the summation of a number of effects, of which inherent resistance is only one, others being the amount of primary infection carried by the seed, and the size of the plant [cf. ibid., xx, p. 102]; it is possible, however, that in Uganda blackarm may be controlled, perhaps, by a number of genes and modifiers, so that a single observation, which represents the summation of them, may always have some value.